Results of the Integrated Pest Management (IPM) Grower Survey and Demonstration Project to Determine IPM Adoption Strategies for Corn, Soybeans, and Small Grain in the Coastal Plain of Virginia

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ACKNOWLEDGMENTS

TABLE OF CONTENTS

EXECUTIVE SUMMARY

We designed three surveys (one for each commodity) to determine what integrated pest management (IPM) practices corn, soybean, and small grains farmers in the coastal plains region of Virginia are and are not using, and why. This information could be useful for research and Extension personnel to determine what farmers need in terms of IPM programs, and would indicate areas where farmers need more education, service, or support. Survey questions were based on meetings with Extension Specialists, Virginia Cooperative Extension Agriculture and Natural Resources (ANR) Agents, and farmer focus groups, where current IPM practices were discussed. Surveys were distributed to 249 individuals per commodity in October 2002. This summary provides a general overview of the survey findings. More detailed results are given in the "Survey Findings" section and in the Appendix.

Important pests: Farmers indicated their major weed, disease, insect, and animal pests.

- Major pests of **corn** included morningglory, pigweed, Italian ryegrass, johnsongrass, lambsquarters, honeyvine milkweed, European corn borer, soil insect pests, deer, and crows. Less than one-third of respondents indicated moderate or major problems with disease.

- Major pests of **soybean** included morningglory, lambsquarters, pigweed, corn earworm, soybean looper, groundhogs, and deer. Less than one-third of respondents indicated moderate or major problems with disease. Nematodes were not considered a problem by most soybean farmers.

- Major pests of **small grains** included Italian ryegrass, wild garlic, chickweed, henbit, vetch, powdery mildew, barley yellow dwarf, *Septoria*, head scab, cereal leaf beetle, aphids, deer, and geese.

Farmers often used the following IPM practices:

- Scouting for weeds and insects in all three commodities
- Using scouting to determine whether herbicide applications are needed in all three commodities
- Basing herbicide selection on weed scouting in all three commodities
- Use of scouting to manage weeds and diseases in future crop rotations in all three commodities
- Rotation of herbicide modes of action between crops in all three commodities
- Use of reduced-till or no-till practices in all three commodities
- Selection of disease-resistant corn and small grains varieties
- Use of rapid canopy closure to control weeds in soybean
- Having agricultural suppliers or chemical dealers scout for diseases and insects in small grains

- Use of thresholds for corn earworm in soybean and cereal leaf beetles and aphids in small grains

Farmers rarely used the following IPM practices:

- Having independent crop consultants scout for weeds, diseases, and insects in all three commodities
- Having ANR Agents scout for weeds, diseases, and insects in corn and soybean
- Use of cultivation to control weeds in all three commodities
- Making maps of weed hotspots in a field in all three commodities
- Use of bait stations, baited wire traps, and digging and counting to monitor soil insect pests in corn

Use of IPM resources available on Virginia Tech's website:

- Usage of four IPM resources available on the Internet was 15.3% or less, with the exception of the corn earworm advisory, which had 55.2% usage.

Reasons for use or non-use of IPM practices:

- Farmers indicated that IPM is important to them.
- Farmers have some time available to scout their fields.
- Farmers have confidence in their pest identification skills.
- Farmers are generally aware that pest thresholds are available, especially for their most important species.
- Small grains and corn diseases are more of a concern for farmers than soybean diseases.
- Crop rotation helps to avoid diseases, weeds, and insects, maximizes land usage and profits, and affects nutrient management practices.
- Farmers have equipment capable of planting soybean in narrow rows (to control weeds using rapid canopy closure).
- There is a lack of awareness of Internet IPM resources, and many farmers do not have computer access.
- The corn earworm advisory had higher percent usage than other Internet resources because it is also available through local media.

INTRODUCTION

Integrated pest management (IPM) is the use of cultural, biological, genetic, and chemical tactics to keep pests at an acceptable level, is economically feasible, and minimizes adverse environmental impact. A tenet of IPM is reduced pesticide usage. There are many constraints to IPM adoption on the farm (Herbert 1995). Drost et al. (1996) reported that time, information, and marketing were important considerations in whether farmers adopt new practices, and these are areas where Extension can provide assistance. We designed a survey to determine what IPM practices corn, soybean, and small grains farmers in the coastal plains region of Virginia are using, and why they are using them. Also, we wanted to determine why some IPM practices are not being used. This information could be useful for research and Extension personnel to determine what farmers need in terms of IPM programs, and would indicate areas where farmers need more education, service, or support.

We wanted to ask appropriate questions on the surveys, and to do this required the cooperation of many people. Project personnel consisted of an Extension Entomologist, two members of the Virginia Department of Conservation and Recreation, a project director, and a project consultant from the Center for Agricultural Partnerships. Ten Virginia Cooperative Extension Agriculture and Natural Resources (ANR) Agents representing counties in the coastal plains of Virginia where the project was conducted assisted us with the project.

In February and March 2002, we interviewed four Virginia Tech Extension Specialists (two entomologists, one plant pathologist, and one weed scientist). The Extension Specialists provided current information about the pest status in Virginia corn, soybean, and small grains, and detailed the IPM practices available for those pests. Information from the interviews and publications by the Extension Specialists were compiled into a PowerPoint presentation.

A separate meeting was held with the ANR Agents who provided the names of farmers who might participate in focus groups and a mailing list of farmers in their county. We introduced the meeting with the PowerPoint presentation, which served as a reminder about current pests and IPM practices. The presentation also stimulated conversation and provided a structured meeting. Agricultural suppliers and chemical dealers were invited to the meeting, but none could attend. However, we did discuss IPM practices via telephone with two of them. These discussions gave us more specific information about the IPM practices used in Virginia.

The ANR Agents gave us contact information for six to eight farmers per county who might participate in a focus group study. We telephoned these farmers in early July and asked them if they would attend a session to discuss IPM. Out of 56 farmers, 23 agreed to meet and discuss IPM at one of three focus groups. One focus group was held for each commodity in mid-July. The corn and soybean focus groups were held at a local Extension office, and the small grains focus group was in a private room at a local restaurant. Meals were provided as an incentive for the farmers. The Center for Agricultural Partnerships consultant served as moderator for the discussions. The meetings were tape recorded (with the farmers' permission) to ensure that all comments were accurately reported. Farmers were assured that names would not be associated with any comments. The farmers indicated their most important pest problems, what they need

IPM practices for, which IPM practices they like, which IPM practices are not practical, and what they expect from Extension and researchers in relation to IPM.

In August and September, we drafted one IPM survey for each commodity. The ANR Agents reviewed the surveys, and final versions were prepared by late September. Each survey was six pages in length, and sought to obtain farmers' opinions on weed, disease, and insect IPM. Farmers were asked to state their feelings on a Likert-type scale of 1-4 (1 = very false, 4 = very true) (Rea and Parker, 1997). In another section of the survey, farmers were asked to indicate all weeds, diseases, and insects that were moderate or major pests on their farm for a specific commodity. Limited demographic information was collected; we only asked for crop acreage and the county where the crop was grown. Finally, farmers were asked in the form of multiple-choice questions if they had ever used specific IPM resources available on the Internet, and why they were (or were not) used.

A single mailing list was created by combining all lists supplied by ANR Agents. Duplicate names and addresses were eliminated. The list was sorted alphabetically, and was printed in three columns. The randomization for the mailings was done by column (all names in column one would receive the corn survey, the soybean survey would be distributed to those in column two, and those in column three were sent the small grains survey). This was done so that relatives that worked on the same farm would most likely receive different surveys. Surveys were coded to keep track of returns. If the recipient of the survey did not farm anymore, they could indicate this on the first question of the survey, and could send it back to us without having to answer any additional survey questions. This benefited non-farmers by saving them time and halting future mailings to them, and saved us future printing and mailing expenses.

The Agriculture and Extension Communications Director at Virginia Tech provided 6 by 9-inch envelopes for the first mailing. His office was able to pre-address the envelopes using our mailing list. A cover letter explaining the project, the survey, and a self-addressed stamped envelope were enclosed. The first mailing was sent to 747 residences during the first week of October. The postage on the return envelope was sufficient to cover the survey plus one additional sheet of paper (occasionally the respondent would enclose a personal note along with the completed survey).

Since we planned future mailings to encourage returns, keeping track of survey returns was important. Two copies of the original mailing list were printed on Avery 5160 white mailing labels. The coded surveys allowed us to remove names from this list as surveys were returned. Remaining address labels would be attached to reminder postcards and replacement surveys. Reminder postcards were mailed during the second week of October, and the replacement survey was sent the third week in October. Overall, we had a 49.1 % survey return rate, 24.6% of which were usable. The unusable surveys were mostly from those who no longer farmed; several had been sent to recently deceased individuals, and several were returned for having insufficient addresses. Surveys were accepted through November 2002.

Summaries of focus group findings, survey findings, reasons for use or non-use of IPM practices, and recommendations for improving IPM adoption are presented in the following sections.

FOCUS GROUP SUMMARIES

Three focus groups were held in Tappahannock and Glenns, VA, in July 2002 to discuss IPM practices with farmers. Each focus group discussed one commodity (corn, soybean, or small grains). Attending farmers were asked to complete a one-page questionnaire prior to the meeting. Results of these short questionnaires are included with each focus group summary, but please note that these are different from the six-page questionnaires that were distributed to 747 people in the main survey. A general summary and a summary of each commodity focus group are provided in the following sections.

A. General summary of the three focus groups
B. Corn focus group summary
C. Soybean focus group summary
D. Small grains focus group summary

A. General summary of the corn, soybean, and small grains farmer focus groups

Moderators: Susan Pheasant and Sean Malone

Attendees: Sparky Crossman, Winston Ellis, Robert Respess, Joe Reamy, James Minor, Bruce Beahm, Charles Rich, Bruce Johnson, Brian Barnes, Bobby Vanlandingham, Clem Horsley, Keith Horsley, George Fisher, Ray Davis, Al France, Evans Lewis, Calvin Haile, David Taliaferro, Lowell Starr, Jock Chilton, Rob Waring, Troy Johnson, Robert Mitchell

Purpose: Twenty-three farmers participated in one of three IPM discussion groups conducted from July 16-18, 2002. We thank them for their participation. Each group discussed IPM practices for corn, soybean, or small grains. We used this information to develop farmer IPM surveys. A summary of the farmers' opinions about IPM is provided below.

Summary of findings from the pre-discussion survey

Counties represented: Attending farmers grew corn, soybean, and/or small grains in one or more of the following counties: Caroline, Essex, Gloucester, James City, King and Queen, King William, Lancaster, Mathews, Middlesex, New Kent, Northumberland, Richmond, and Westmoreland.

Crop acreage: In the 2002 season, attending farmers averaged 664 acres of corn (std. dev. = 556), 693 acres of soybean (std. dev. = 450), and 406 acres of small grains (std. dev. = 316).

Interest in IPM: Eleven farmers indicated that they had a high interest in IPM, ten had moderate interest, and one had low interest.

Summary of farmers' opinions about IPM practices

Weeds: Italian ryegrass was identified as one of the most important weed pest of corn and small grains. It is a widespread no-till problem, and farmers are worried about it becoming resistant to herbicides such as Roundup (glyphosate). Additionally, with the loss of Bladex (cyanazine) for Italian ryegrass control, research and development of other effective herbicides is needed. Farmers would like state highway crews and contractors to stop planting this pest.

Weeds are not much of a problem for farmers using Roundup-Ready soybean. However, farmers are concerned about weed resistance to herbicides (especially Italian ryegrass and marestail), and they would like to have a diverse selection of herbicides in case resistance problems occur.

Farmers often make site-specific herbicide applications. Few use cultivation for weed control. The electronic weed identification guide was praised for being a good source of information, but farmers asked if it could include photographs of weeds at multiple stages in their lifecycle, and if a hard-copy weed guide could be developed. Better awareness of the guide is recommended.

Diseases: Most farmers use disease-resistant varieties and crop rotation to reduce incidence of disease. Farmers want to maintain a toolbox of disease-resistant varieties, for plant resistance does not last forever. A better way to diagnose disease problems is needed, especially when symptoms first appear. Diseases are not always obvious to the farmer, and are often hard to differentiate from nutrient or mineral deficiencies.

Soybean farmers mentioned that soil samples for nematodes are not often taken because they rely on rotation and resistant varieties to solve nematode problems, and that nematode-related problems are not always obvious.

Insects: Farmers asked for more information about thrips on soybean, for more details about scouting spider mites in soybean, and for more information about when it is necessary to spray for defoliating insects in soybean.

Farmers requested the development of thresholds for beneficial insects.

Corn farmers asked for a better way to sample white grubs than using baited wire traps. They want to know if any seed treatments or starter fertilizers are effective in controlling white grubs. Farmers asked if applying insecticide to wheat would control overwintering white grubs, thereby reducing the population in corn planted the following spring.

Wildlife: Deer are a major problem in corn, soybean, and small grains. Geese, groundhogs, wild turkeys, and blackbirds are other important animal pests. Farmers asked for help in controlling these economically important pests.

General comments

Farmers want rotation-specific IPM practices, not crop-specific. For example, it may be necessary to control a weed, disease, or insect in one crop to prevent it from becoming a pest in another crop.

Most farmers scout for weed, disease, and insect pests. Lack of time to scout was repeatedly mentioned as a drawback to this IPM practice. Farmers from every discussion group appreciated the service that ANR Agents provide; they mentioned that Extension personnel did a lot of scouting and found things that many farmers would have overlooked. They liked the direct contact that ANR Agents provide. Farmers want to maintain the ANR Agent structure within Virginia Cooperative Extension to provide unbiased answers to their pest problems, and to assist them with scouting and thresholds. Ideally, the Area IPM Coordinator position would be returned, and ANR Agents would be able to devote all of their time to commercial agriculture. Farmers appreciated the efforts of the Extension Specialists, who serve as the source of the unbiased information that is passed down to them through Extension personnel and industry representatives. Farmers asked that the Extension Specialists provide them with timely pest alerts, devise economic threshold calculators, and continue to improve thresholds so that pest problems can be identified and treated (if necessary) at the earliest possible stage. "Refresher courses" in IPM would benefit the farmers and would give them more confidence in their

scouting abilities. Courses on use of technology were also requested. For example, farmers would like to learn how to take and send digital photographs of a pest to an Extension Specialist for identification, and would like to learn how remote sensing can be used to help them scout fields. Several farmers asked for classes on general computer use.

Farmers encouraged research on plant breeding, pest-resistant varieties, and pesticides. They want products that address current pest problems.

No-till systems are popular with farmers. Farmers using no-till save money and time by spending fewer hours on the tractor, having less wear and tear on the equipment, and having reduced labor requirements. However, there was concern that no-till fields harbor more insects, weeds, and diseases than conventional-till fields. Also, soil compaction problems occur in no-till fields.

Farmers want to know what specific practices constitute "IPM." For example, farmers asked if planting Bt corn and Roundup-Ready soybeans are IPM practices.

B. Summary of the corn farmer focus group

Location and date: Tappahannock County Extension Office, 16 July 2002

Moderators: Susan Pheasant and Sean Malone

Attendees: Al France, Evans Lewis, Calvin Haile, David Taliaferro, Lowell Starr, Jock Chilton, Rob Waring, Troy Johnson, Robert Mitchell

Purpose: This research is being conducted to determine what is needed in order to increase farmer participation in the implementation and adoption of IPM practices in Virginia coastal plains corn, soybean, and small grains crops. Specifically, we want to determine which IPM practices are being used by Virginia farmers, which ones are under-utilized, and why (or why aren't) Farmers using IPM practices. Information from the discussion group will be used to design an IPM survey that will be distributed to Virginia farmers. Nine farmers participated in this corn IPM discussion group, and we thank them for their participation. At the beginning of the meeting, farmers gave us information about their farming operations, and completed a one-page IPM survey. During the meeting, the moderators asked the farmers five questions concerning corn IPM practices. The questions asked to the farmers are supplied and the pre-discussion survey results are provided. A summary of the survey and the farmers' responses to the questions follow.

Summary of findings from the pre-discussion survey

Counties represented: Attending farmers grew corn, soybean, and/or small grains in one or more of the following counties: Essex, King and Queen, King William, Lancaster, Middlesex, Northumberland, Richmond, and Westmoreland.

Crop acreage: In the 2002 season, attending farmers averaged 881 acres of corn (std. dev. = 747), 864 acres of soybean (std. dev. = 576), and 532 acres of small grains (std. dev. = 365).

Interest in IPM: Three farmers indicated that they had a high interest in IPM, five had moderate interest, and one had low interest in IPM.

IPM information sources: Farmers often turned to Virginia Cooperative Extension ANR Agents, chemical company representatives, and agricultural suppliers to get their information about IPM. Farmers occasionally used the Internet, Extension Specialists, field days, and other farmers as sources of IPM information.

Summary of farmers' opinions about corn IPM practices

Weeds: Farmers identified trumpet creeper, hemp dogbane, honeyvine milkweed, and Italian ryegrass as the most important weed species in the coastal plains region of Virginia. Other

weeds of concern included mug wort, horsenettle, Japanese bamboo, johnsongrass, shattercane, morningglory, lambsquarters, and pigweed.

Farmers routinely scout for weeds (all farmers indicated that they scout for weeds on the survey), but wish that scouting techniques were more efficient so that they would not have to walk the entire field, and were less time consuming. Some weeds such as Italian ryegrass, pigweed, and lambsquarters appear to be more concentrated on field edges than in the center. One farmer mentioned that he has tried flying over his fields in an airplane in order to scout weeds more efficiently.

It was suggested that if remote sensing technologies such as satellite photographs were more affordable and available, they could be efficient weed-scouting tools. The images would be needed mostly during May and early June. Additionally, a good weed scouting system would allow the incorporation of variable-rate spray technology. According to the survey, seven of nine farmers make site-specific herbicide applications.

The farmers felt that there was a need to develop and field-test new herbicides. This would help with Italian ryegrass control, since it exhibits diclofop (Hoelon) resistance, and since Bladex is no longer available for its control.

The group observed that the Virginia Department of Transportation planted ryegrass seed along highways, and felt that this practice should be discontinued, as it is a weed seed source.

Six of nine farmers have tried cultivation for weed control, but no longer use this IPM practice. Only one farmer indicated that he still used cultivation.

It was mentioned that a systems approach to weed control is necessary. For example, hemp dogbane needs to be controlled in soybean so that it does not become a major problem in corn. Also, fall herbicide applications (after the corn has been harvested) may be more efficient at killing the roots of weeds than spring applications.

Diseases: Seven of nine farmers indicated that they scout for disease. Farmers were concerned about smut, *Fusarium*, and mosaic dwarf diseases. They did not consider gray leaf spot a problem in their region.

Farmers stated that selecting resistant cultivars prevented most diseases. They want to maintain a toolbox of disease-resistant cultivars.

Farmers observed that *Fusarium*, which is associated with the corn stalk, is worse in dry seasons, and is a problem when corn follows corn. Due to its potential to affect small grains, *Fusarium* control should be a systems approach. Also, a systems approach for controlling mosaic dwarf is needed. Aphids that vector the virus which causes the disease can live on johnsongrass weeds.

Mineral deficiencies are an increasing problem. Specifically, Magnesium and Boron deficiencies have been seen when no starter fertilizer was applied, or when no Magnesium or

Boron applications were made. Farmers observed that mineral deficiencies were more pronounced in residues behind the machinery.

Insects: Farmers considered white grubs the most important insect pest of corn in their region. Other insect pests included wireworms, seedcorn maggots, rootworms, and cutworms.

Farmers need better white grub scouting techniques and thresholds. Farmers want a way to sample white grubs more effectively than using baited wire traps. Five farmers had heard of the IPM practice of using baited wire traps and thresholds for seed pests, but only one actively used them. Another farmer had discontinued using the baited wire traps. They feel that the traps are too labor-intensive. Four farmers used a shovel to dig and count white grubs before planting, and two had tried this practice but stopped using it. One farmer mentioned that he used a shovel to sample for white grubs, but felt that he was wasting his time. Another mentioned that he might find grubs while checking seed depth at planting. If white grub sampling and thresholds are not used, a farmer has nothing on which to base in-furrow treatment decisions. An in-furrow insecticide treatment may cost $16-18 per acre. One farmer mentioned that he saw ten-foot gaps in his rows due to white grubs.

Farmers want to know if seed treatments such as imidacloprid (Gaucho) are effective in controlling white grubs.

Farmers want to learn more about the white grub lifecycle, and if they come to the soil surface at any time. Information on peak white grub activity (specifically, which weeks or months) would help farmers determine if their fields were at risk. They want to know at what time of the year samples should be taken, and how many white grubs it takes to justify treatment with insecticide. Also, they want to know how much damage it takes to justify replanting, and if weather influences damage levels.

Most farmers do not apply in-furrow insecticides for white grubs unless they are planting into clover. They observed that white grubs are a problem in no-till corn rather than in conventional till, and noted that stubble promotes white grub populations. Opinions differed as to the effectiveness of a starter fertilizer application in controlling white grubs.

Three farmers used the Virginia Insect Control Expert for corn website, and three others had heard of it.

Five farmers indicated that they scout and use thresholds for cutworm, and six used armyworm thresholds. Three used the IPM practice of planting Bt corn to prevent European corn borer when they had to plant late.

Wildlife pests: Farmers considered deer the most important animal corn pest. Other pests mentioned included wild turkeys, squirrels, grackles, and raccoons.

Deer are an increasing problem for all crops, and farmers want better deer management practices. This could include hunting options such as better doe control. Several farmers commented that sludge keeps deer out of the field.

Problems associated with no-till corn: White grubs, perennial weeds (especially on field edges), and soil compaction (especially on edges of field) were considered to be major problems associated with no-till corn practices.

Role of Extension and Research, with regard to IPM: Farmers need and want to maintain the ANR Agent structure with Virginia Cooperative Extension. They need people knowledgeable about pests and thresholds, and who have time to help scout their fields and respond to specific problems.

The farmers liked being advised of pest statuses through mailings and emails.

There was some concern that ANR Agents have to schedule time for 4-H camps and garden clubs, when their assistance is needed in commercial agriculture. It was mentioned that there seems to be more bureaucracy in Extension now than ten years ago.

Research on chemical products needs to be continued. They want to maintain availability of effective products, and develop products to address current pest problems (as described above). Efficacy of products should be reported.

Additional comments: A farmer mentioned that he would like to see development of a corn variety for milling (as opposed to feed corn) that would prosper under Virginia coastal plains conditions.

Suggestions for improving future discussion groups: Farmers mentioned that an advance mailing of the survey would be beneficial. Every other row on the survey should be shaded for ease of reading.

Corn focus group questions

We asked attending farmers the following questions:

1. (part a) Looking back at your corn farming operation over the past several years, what are the most important pest problems (weed, disease, and insect) that you have had to address?

   (part b) Were there any specific problems associated with reduced-till farming practices?

2. What specific pests do farmers need IPM practices for?

3. What IPM practices have you tried and liked, and why?

4. What IPM practices are not practical to use, and why?

5. What role should Extension and Research have in relation to IPM, and how can they better suit your needs?

Corn focus group survey results

1. Counties in which you grow corn, soybean, or small grains (please check all that apply):
n = 9 farmers

County	No. of attending farmers with c/s/sg acreage in this county
Caroline	0
Charles City	0
Essex	4
King & Queen	3
King William	1
Lancaster	2
Middlesex	1
New Kent	0
Northumberland	1
Richmond	2
Westmoreland	1
Other (please list)	0

2. Please indicate the approximate acreage you planted for each crop in the 2002 season.
n = 9 farmers (all attendees had corn, soybean, and small grain acreage)

Crop	Mean Acres Planted in 2002	Std. Dev.
Corn	881.2	747.4
Soybean	864.1	576.0
Small grains	532.2	365.4

3. How would you characterize your interest in integrated pest management (IPM)? Numbers in parentheses indicate the number of responses. **n = 9 farmers**

High interest (3)	Moderate interest (5)	Low interest (1)	No interest (0)

4. Where and how frequently do you get your information about IPM? Please check one box for each information source. **n = 9 farmers**

Information source	Often	Occasionally	Never
Internet	1	5	0
Extension agents	6	3	0
Extension specialists	3	6	0
Meetings/field days	2	7	0
Other farmers	2	6	0
Chemical company representatives	5	2	1
Agricultural suppliers	5	2	2
Other source (please list)	0	0	0

5. Please indicate your experience with the following topics by marking the appropriate box.
Numbers indicate the number of responses for each category. **n = 9 farmers**

	Have heard of the practice/tool	Know someone who uses the practice/tool	Have tried the practice/tool but no longer use it	I use the practice/tool
WEEDS				
Scout for weeds				9
Electronic Weed ID Guide	3	1		2
Make site-specific herbicide applications				7
Cultural weed control such as cultivation			6	1
Keep all fields in a crop rotation clean	2			6
Make a map/keep a record of weed hotspots	2			4
Other				
DISEASES				
Scout for disease	1			7
Select corn cultivars resistant to gray leaf spot	2	1	1	4
Rotate crops to reduce gray leaf spot	2			5
Other				
INSECTS				
Post-emergence scouting and thresholds for cutworm	1		1	5
Post-emergence scouting and thresholds for armyworm	1		1	6
Early planting to prevent European corn borer	3		1	3
Use Bt corn to prevent European corn borer if planting after May 15	2	1	1	3
Use baited wire traps/bait stations and thresholds for seed pests (wireworms, seed corn maggot, and white grubs)	5		1	1
Dig for samples and count white grubs before planting corn	2		2	4
Virginia Insect Control Expert for Corn website	3			3
Other				

C. Summary of the soybean farmer focus group

Location and date: Tappahannock County Extension Office, July 16, 2002

Moderators: Susan Pheasant and Sean Malone

Attendees: Sparky Crossman, Winston Ellis, Robert Respess, Joe Reamy, James Minor, Bruce Beahm

Purpose: This research is being conducted to determine what is needed in order to increase farmer participation in the implementation and adoption of IPM practices in Virginia coastal plains corn, soybean, and small grains crops. Specifically, we want to determine which IPM practices are being used by Virginia farmers, which ones are under-utilized, and why (or why aren't) farmers using IPM practices. Information from the discussion group will be used to design an IPM survey that will be distributed to Virginia farmers. Six farmers participated in this soybean IPM discussion group, and we thank them for their participation. At the beginning of the meeting, farmers gave us information about their farming operations, and completed a one-page IPM survey. During the meeting, the moderators asked the farmers five questions concerning soybean IPM practices. The questions asked to the farmers and the pre-discussion survey results are provided. A summary of the survey and the farmers' responses to the questions follow.

Summary of findings from the pre-discussion survey

Counties represented: Attending farmers grew corn, soybean, and/or small grains in one or more of the following counties: Caroline, Essex, Northumberland, Richmond, Westmoreland, Mathews, and Gloucester.

Crop acreage: In the 2002 season, attending farmers averaged 392 acres of corn (std. dev. = 249), 452 acres of soybean (std. dev. = 176), and 314 acres of small grains (std. dev. = 200).

Interest in IPM: Three farmers indicated that they had a high interest in IPM, and three had moderate interest.

IPM information sources: Farmers often turned to Virginia Cooperative Extension ANR Agents, Extension Specialists, field days, other farmers, and chemical company representatives for information about IPM. Occasionally they obtained information from agricultural suppliers and the Internet.

Summary of farmers' opinions about soybean IPM practices

Weeds: According to the farmers at the meeting, weeds are "not the issue they were five years ago because of Roundup-Ready soybeans." However, there is concern about weed resistance to Roundup (glyphosate) and the potential lack of diversity in products. Also, it must be remembered that Round-Ready soybeans are not planted in every field (one attending farmer did

not plant them at all). Farmers noted that marestail was becoming resistant to Roundup.
Marestail can be a problem especially in early-planted or no-till soybeans. Other weeds of
concern include lambsquarters, pigweed, dogbane, and morningglory.

Four of five farmers indicated that they scout for weeds in soybean. However, the major
drawback to scouting weeds is lack of time. One farmer said, "I find it helpful getting somebody
to scout with you, because I can't keep up with it all." The electronic weed identification guide
was praised for being a good source of information, but some were unaware of it, and on the
survey only one farmer indicated that he used this IPM resource.

Farmers said that they make mental maps of problem areas in fields. One farmer indicated that
he recorded weed hotspots on paper. Using this information allows for site-specific herbicide
applications, which according to the survey was done by most farmers.

Some farmers use narrow row spacing or early planting to accelerate canopy closure, which
helps to shade out weeds.

Diseases: Farmers indicated that they had no major soybean disease problems. Due to little
disease pressure, most do not check for disease. They stated that using disease-resistant varieties
and crop rotation helps to avoid nematode problems. According to the survey, most farmers
used these two IPM practices. Three farmers took soil samples for nematodes, but they
mentioned that others rarely take soil samples for nematodes because they rely on rotation and
variety selection to take care of the problem. Other reasons why nematode samples are not taken
are that nematodes are not a visible pest and are therefore not well understood by the farmer, and
the disease associated with the nematodes is not always obvious. However, the farmers said that
if a problem appeared, they would investigate its source. One person characterized the attitude
towards diseases: "Farmers know that diseases are there, but can't do a whole lot about them."

Wondering whether any further increase in yield could be "squeezed out" of soybean by
controlling diseases, one farmer said, "soybean yield increases come in very small doses due to
few readily identifiable pest problems to combat."

Farmers had several disease-related questions. They asked if thrips are causing a wilt virus on
soybean, and if using Temik (aldicarb) for nematodes will help prevent thrips from stunting
plants and possibly reducing yield.

Insects: Farmers identified the corn earworm as the most important insect pest of soybean in the
coastal plains region of Virginia. Three attending farmers used the corn earworm advisory, and
four scouted and used thresholds for this pest. They considered the available corn earworm IPM
information adequate and helpful, and mentioned that farmers need to take time to scout for this
pest. The group felt that the information flow (from the Extension Specialist to ANR Agents and
industry representatives to farmers to other farmers) was appropriate. One farmer said that he
probably scouts more for corn earworm than anything else. One farmer described how he plants
maturity group IV soybean furthest away from his home since these beans mature faster than
higher-numbered maturity groups, and maturity group IV pods become too hard for corn
earworm to feed on. This means that he will have to scout the distant maturity group IV soybean

less often. He plants maturity group V soybean closer to home (within five miles) so that he doesn't have to travel as far to scout them. A farmer stated that he thought his corn earworm threshold may be slightly less than published thresholds, and that he will sometimes spray early for the pest because he feels better when he sprays for it, plus his chemical has a long residual activity.

Spider mites were considered the next most important insect pest of soybean. They are typically a dry-weather problem. Farmers asked if they could obtain more details about scouting for spider mites, and if any beneficial organisms help to control spider mites.

Stink bugs and leaf-feeding insects were identified as occasional pests of soybean. Farmers want to know when they need to spray for the leaf-feeding insects, if it is necessary at all.

Farmers wondered if Mexican bean beetle would become a future problem. One person had Mexican bean beetle larvae in his home garden's string beans.

Farmers were concerned that residue in no-till fields could harbor more insect pests than in conventionally tilled fields.

Farmers asked if using Temik for nematode control would also control thrips, and if it would increase yield.

Farmers want an assessment of how much good beneficial insects are doing. They would like to see threshold numbers for beneficial insects (how many are needed for adequate pest control). Adequate numbers of beneficial insects could prevent or postpone pesticide application(s).

Wildlife pests: Deer and groundhogs are important animal pests of soybean. Farmers noted that deer are an increasing problem, especially on farms near state parks, military bases, and areas of increasing development. Deer eat the leaves of the plant, and most damage occurs along edges of wooded areas.

Problems associated with no-till soybean: Perennial weeds can become a problem when their lifecycle is not disrupted by tillage. Similarly, groundhog dens do not get disrupted in no-till systems. Farmers mentioned that soil compaction associated with no-till systems may reduce yields, and they feel that they need to check for soil compaction more often. Farmers want to know if crop residue is providing a safe-haven for insects, which could allow pest numbers to increase over time. Specifically, they were concerned about Mexican bean beetle making a comeback. In light of these negative aspects, no-till soybean systems are popular among farmers. It was said "no-till beans are a plus and a plus again."

Other problems: Farmers said that they had more problems with nutrient deficiencies (specifically Manganese) than with diseases. They felt that nutrient deficiencies might be responsible for reduced yields.

Reasons why IPM practices are used: Generally, farmers will use an IPM practice if it can save them money and time. This occurs in no-till systems, for they spend fewer hours on the tractor,

have less wear and tear on equipment, and reduced labor-force requirements. Site-specific herbicide applications save money.

Farmers found the weed identification website and pest advisories/updates by county helpful. These gave them an idea of when to start looking for pests, and what to be looking for. One farmer said, "it is important to base decisions on real information, not assumptions."

Farmers stated that ANR Agents, fertilizer salespersons, etc. keep up with pest problems and assist them with scouting. They like having unbiased information coming from the Extension Specialists and ANR Agents, but often interact more with industry representatives. One farmer mentioned that his fertilizer salesman tries to save him money by scouting for pests and making good recommendations, hoping that the farmer will purchase fertilizer from him in the future.

Reasons why IPM practices are not used: The number one reason that farmers do not use IPM practices is the time that it takes to scout fields for pests. One person mentioned that the larger the farm, the less time a farmer has to scout.

Farmers may not have confidence in their scouting ability and may be unsure of what to look for. Some may not understand the issues, or may feel that an IPM practice is not practical to use. A refresher course in scouting may help.

Sometimes it is easier for the farmer to spray for a pest, especially if he/she scouted and found pest numbers slightly below the threshold ("borderline" pest levels). Spraying is considered easier and less time consuming than going back again on another day to scout.

It is difficult to take sweep-net samples for insects in drilled or narrow-row soybean.

There are no thresholds available for beneficial insects in soybean. Also, faith in beneficials is questionable, for farmers do not always trust that beneficials will control the pest(s).

The farmer may rely on other people (for example, ANR Agents and chemical/fertilizer representatives) to provide them with information about pests.

Farmers may be waiting to see if weather causes pest problems to become better or worse.

Some farmers were unaware of the electronic weed identification website.

Few farmers use the moldboard plow due to the popularity of no-till practices. Few cultivate their fields for weed control.

Farmers tend to use mental, not paper, maps of pest hotspots in their fields.

Nematodes are rarely sampled because the diseases associated with them are not always obvious, and farmers hope that crop rotation and resistant varieties will preclude the problem.

Role of Extension and Research, with regard to IPM: Farmers want to maintain good ANR Agents. They often look to ANR Agents for information about IPM. Extension provides farmers with unbiased information and assists with scouting their fields. Farmers feel that Extension Specialists and Virginia Cooperative Extension should remain in touch and cooperate with industry representatives to keep information accurate. One farmer said, "I feel more comfortable talking to an Extension Agent than I do a salesman," but farmers tend to interact more with industry representatives. Also, farmers still appreciate direct contact with the Extension Specialist.

Field days are a good source of IPM information. Farmers feel that on-farm trials are more realistic than small-scale trials, and they encourage researchers to continue to replicate their experiments in different environments and situations.

Suggestions for improving future discussion groups: Farmers mentioned that we should keep discussion groups small (similar to the size of their group).

Soybean focus group questions

We asked attending farmers the following questions:

1. (part a) Looking back at your soybean farming operation over the past several years, what are the most important pest problems (weed, disease, and insect) that you have had to address?

   (part b) Were there any specific problems associated with reduced-till farming practices?

2. What specific pests do farmers need IPM practices for?

3. What IPM practices have you tried and liked, and why?

4. What IPM practices are not practical to use, and why?

5. What role should Extension and Research have in relation to IPM, and how can they better suit your needs?

Soybean focus group survey results

1. Counties in which you grow corn, soybean, or small grains (please check all that apply):
n = 6 farmers

County	No. of attending farmers with c/s/sg acreage in this county
Caroline	1
Charles City	0
Essex	1
King & Queen	0
King William	0
Lancaster	0
Middlesex	0
New Kent	0
Northumberland	1
Richmond	3
Westmoreland	4
Other: Mathews	1
Gloucester	1

2. Please indicate the approximate acreage you planted for each crop in the 2002 season.
n = 6 farmers (all attendees had corn, soybean, and small grains acreage)

Crop	Mean Acres Planted in 2002	Std. Dev.
Corn	392	249
Soybean	452	176
Small grains	314	200

3. How would you characterize your interest in integrated pest management (IPM)? Numbers in parentheses indicate the number of responses. **n = 6 farmers**

High interest (3)	Moderate interest (3)	Low interest (0)	No interest (0)

4. Where and how frequently do you get your information about IPM? Please check one box for each information source. **n = 6 farmers**

Information source	Often	Occasionally	Never
Internet	1	2	2
Extension agents	6	0	0
Extension specialists	3	2	0
Meetings/field days	4	2	0
Other farmers	3	2	0
Chemical company representatives	3	3	0
Agricultural suppliers	2	3	0
Other source (please list)	0	0	0

5. Please indicate your experience with the following topics by marking the appropriate box.
Numbers indicate the number of responses for each category. **n = 5 farmers**

	Have heard of the practice/tool	Know someone who uses the practice/tool	Have tried the practice/tool but no longer use it	I use the practice/tool
WEEDS				
Scout for weeds		1		4
Electronic Weed ID Guide	1			1
Make site-specific herbicide applications		1		4
Cultural weed control such as cultivation	1		2	1
Cultural weed control such as early canopy closure	1			2
Keep all fields in a crop rotation clean		1	1	3
Make a map/keep a record of weed hotspots	2			1
Use herbicide-resistant soybean varieties to manage weeds		1		3
Other				
DISEASES				
Take a soil sample/assay for nematodes	1		1	3
Select soybean cultivars resistant to soybean cyst nematode	1			4
Rotate crops to reduce soybean cyst nematode		1		4
Leave land fallow to reduce nematode populations	2			
Other				
INSECTS				
Corn earworm advisory		1		3
Scouting and thresholds for corn earworm		1		4
Use percent defoliation thresholds for leaf-feeding insects (green cloverworm, bean leaf beetle, grasshopper, etc.)	1			2
Use Leaf Area Index (LAI) to indicate crop health	3			
Other				

D. Summary of the small grains farmer focus group

Location and date: Ann's Family Dining Restaurant, Glenns, VA, July 18, 2002

Moderators: Susan Pheasant and Sean Malone

Attendees: Charles Rich, Bruce Johnson, Brian Barnes, Bobby Vanlandingham, Clem Horsley, Keith Horsley, George Fisher, Ray Davis

Purpose: This research is being conducted to determine what is needed in order to increase farmer participation in the implementation and adoption of IPM practices in Virginia coastal plains corn, soybean, and small grains crops. Specifically, we want to determine which IPM practices are being used by Virginia farmers, which ones are under-utilized, and why (or why aren't) farmers using IPM practices. Information from the discussion group will be used to design an IPM survey that will be distributed to Virginia farmers. Eight farmers participated in this small grains IPM discussion group, and we thank them for their participation. At the beginning of the meeting, farmers gave us information about their farming operations, and completed a one-page IPM survey. During the meeting, the moderators asked the farmers five questions concerning small grains IPM practices. The questions asked to the farmers and the pre-discussion survey is provided. A summary of the survey and the farmers' responses to the questions follow.

Summary of findings from the pre-discussion survey

Counties represented: Attending farmers grew corn, soybean, and/or small grains in one or more of the following counties: Gloucester, James City, King and Queen, King William, Lancaster, New Kent, Northumberland, Richmond, and Westmoreland.

Crop acreage: In the 2002 season, attending farmers averaged 616 acres of corn (std. dev. = 371), 679 acres of soybean (std. dev. =370), and 321 acres of small grains (std. dev. = 313).

Interest in IPM: Five farmers indicated that they had a high interest in IPM, and two had moderate interest.

IPM information sources: Farmers often turned to Virginia Cooperative Extension ANR Agents, Extension Specialists, and meetings/field days to get their information about IPM. Farmers occasionally used the Internet, other farmers, chemical company representatives, and agricultural suppliers as sources of IPM information.

Summary of farmers' opinions about small grains IPM practices

Weeds: Most attending farmers indicated that they scout for weeds. They said that Italian ryegrass is the most important weed pest of small grain in the coastal plains region of Virginia. The second most important weeds included speedwell and cornflower/bluegrass. Wild

garlic/onions, and tall meadow oat grass were the next most important weeds. Farmers noted that other weeds in small grains included poanna, vetch, henbit, chickweed, Virginia creeper, little barley, johnsongrass, mugwort/wild chrysanthemum, honeyvine milkweed, common milkweed, marestail, Canadian thistle, and an unidentified small, thick, moss-like weed.

Italian ryegrass is a widespread no-till problem that is hard to detect in its early growth stages. A farmer mentioned that during harvest he saw "loads of wheat come in containing more ryegrass than wheat." Farmers need a better way to recognize the problem, such as an identification guide that they can carry into the field that includes pictures of weeds at all growth stages. It was suggested that this weed be controlled when it appears in corn, so that Roundup (glyphosate) may be used. They are concerned that Italian ryegrass could develop resistance to Roundup, and want more effective chemical controls. Bladex is no longer available for Italian ryegrass control. They explained that Italian ryegrass is not considered a noxious weed in Virginia, and is being planted by state highway crews and contractors. Farmers request that these crews stop planting Italian ryegrass.

Some farmers were concerned that tall meadow oat grass could become more of a problem in the future. They asked for a weed identification guide with more photographs of the weed growth stages, from emergence through maturity.

Diseases: According to the survey, farmers scout for diseases. The most important disease pest of small grains was scab. This is an increasing problem with no-till systems.

Powdery mildew was identified as the second most important disease of small grains in the region. The farmers said that 'Roane' wheat lost its resistance to powdery mildew in the 2002 growing season.

Other disease pests included *Septoria* leaf and glume blotch, spindle-streak mosaic virus, barley yellow dwarf, leaf rust, and take-all.

Farmers asked if disease causes stalks to weaken and become more susceptible to lodging.

Farmers stated that diseases are often hard to differentiate from nutrient deficiencies. For example, spindle-streak mosaic virus and manganese deficiency look the same. They need a way to differentiate between disease and nutrient deficiency when symptoms first appear.

Insects: Farmers scout for insect pests in their small grains crops. The two most important insect pests of small grain are cereal leaf beetles and aphids. Farmers are satisfied with the new cereal leaf beetle threshold, which allows them to treat for this pest earlier (if treatment is necessary). They want improved thresholds for all pests, to allow earliest possible detection and treatment. Also, this could allow tank mixing of products such as insecticide and nitrogen. One farmer said that by the time aphid thresholds are reached, it may be too late to solve the problem (barley yellow dwarf). This farmer sprayed for aphids when they were below threshold and cured his problem.

Farmers asked if a genetically tougher plant could be developed. For example, they wanted wheat with qualities of "Bt" plants for cereal leaf beetle control, or a tougher flag leaf.

Other insect pests include the Hessian fly, armyworms, thrips, stink bugs, grasshoppers, and a "new" aphid that eats wheat in very early growth stages (before one-leaf stage). This aphid reportedly can kill the stand before the farmer can identify the problem. A farmer observed that the aphid may be associated with a weed host plant, poanna.

Hessian fly could become a problem in no-till small grain, since the system requires earlier planting to take advantage of warmer soil temperatures. Problems with the Hessian fly are more likely to occur when small grains are planted before the fly-free date of mid-October.

Wildlife pests: The most important animal pests of small grains are deer and geese. These pests cause major economic losses to the farmer. One person estimated that he loses $50,000 annually to animals. These two pests are an increasing problem due to human expansion and resident geese returning to the same field annually. One farmer said that the geese eat the young wheat, and the deer eat the remainder.

Other animal pests of small grains include moles, mice, groundhogs, wild turkeys, raccoons, and blackbirds.

Problems associated with no-till small grains: Farmers commented that no-till systems have more weeds than conventionally tilled fields, and therefore require more herbicide applications (also costing more money). Weeds such as Italian ryegrass and wild garlic/onions would typically be destroyed by conventional tillage. There may be problems with herbicide carryover in dry years, and weeds seem to have more vigor in no-till systems.

Farmers see increased scab and barley yellow dwarf in no-till fields.

Hessian fly may infest wheat more often in no-till, due to earlier planting to take advantage of warm soil temperatures.

Soil compaction can be a problem.

Planting in no-till requires a wider drill than conventional tillage (7.5 versus 4 or 6-inches) because plant residues will clog up narrow drills. Farmers note better stands when stalks are not chopped, as plant material left standing allows equipment to pass through without the "bulldozing" effect. More seed is needed in no-till systems, for there is not as much seed-to-soil contact, and planting depth is inconsistent. No-till works better in high-ground fields than in low-ground fields.

Government programs and time requirements affect the decision to no-till.

Other concerns: Farmers want rotation-specific IPM, not crop-specific IPM. For example, controlling white grubs in wheat may reduce the overwintering population, so they would be less of a problem in corn the next season.

Farmers want to know what constitutes "IPM." For example, they want to know if planting Bt corn and Roundup-Ready soybeans are IPM practices.

Farmers mentioned that they would like to see more research on cultivars. The introduction of a wheat cultivar that matured 10 days earlier could increase double-crop wheat acreage. Research on resistant varieties is also desirable.

Farmers are interested in using remote sensing to scout fields.

Farmers would like more educational programs, such as slide shows, to help with identification of pests (specifically weeds).

Some farmers felt that the government was maintaining some ineffective employees and crop programs.

Farmers needed and appreciated the scouting assistance that the Area IPM Coordinator provided.

The Health Department needs to work with farmers when placing wells on properties adjacent to farms. Wells along property lines are problematic because they require an unsprayed border.

The general public should be educated on how farmers are required to follow pesticide label directions and rates. This could help reduce anxiety and tensions that the public feels when they see a farmer spraying chemicals.

Reasons why IPM practices are used: Farmers usually do their own scouting, and according to the survey most scouted for weeds, diseases, and insects. However, farmers feel that they may not be able to scout all of their fields without outside help. They mentioned that Extension personnel did a lot of scouting and found things that many farmers would have overlooked. Phone calls from Extension personnel notifying the farmer to be on the lookout for specific pests were appreciated and useful. Industry representatives or private consultants may assist with scouting. However, farmers need unbiased support with pest identification and thresholds, and said that it is better to have non-salespeople do the scouting to prevent promotion of chemical products.

Reasons why IPM practices are not used: The main reasons for IPM practices not being used include lack of time, money, and not understanding pest thresholds.

From the survey, most farmers had heard of the electronic weed identification guide, but only one used it. The guide was praised for being good in general, but farmers would like photographs of weeds from emergence through maturity. Also, it would help to have a form of the guide to carry into the field. Farmers would like training on how to take and submit digital photographs for identification.

Only two farmers indicated on the survey that they used sanitation to reduce risk of wheat scab and Septoria leaf and glume blotch. Reasons for not using sanitation include the cost it takes to

plow, lack of available time between harvest of the previous crop and small grain planting, and that it is easier to no-till. Some farmers said that they never had a scab problem when no-tilling behind corn, while others had better yields when corn was plowed before planting wheat.

Role of Extension and Research, with regard to IPM: Some farmers feel that their area does not receive adequate support, partly due to loss of the Area IPM Coordinator position and not having a research station nearby. One farmer said that "we've been slighted in this area for ten years, and I think it's time to consider everybody." The farmers want someone available who knows the pests and their thresholds such as an Area IPM Coordinator. They stressed that although there are fewer farmers, there is not any less of a need for information.

Farmers would like more "economic threshold calculators" to be available. These tools consider net profit in making treatment decisions, which is an asset to the farmer.

Farmers would like more pest alerts to be issued. They need timely and accurate reports during peak scouting periods. Alerts could be issued through phone calls, 800 phone numbers, newsletters, email, local news media, post cards, ANR Agents, and/or industry representatives. Farmers asked if interns could assist with scouting during peak times. Also, they would like to have more blacklight traps in use.

Some farmers mentioned that they would like Extension to concentrate more on helping production agriculture, rather than 4-H and Master Gardeners.

Extension could educate farmers on the use of computers, satellite remote sensing, and digital cameras. Simplifying technology would make farmers less afraid to use it.

Identification and education about early weed and disease stages would help farmers better diagnose pest problems. This could be done using seminars, slide shows, identification booklets, etc.

Breeding programs and research on pest-resistant varieties is important.

Farmers would like for Extension and researchers to look at new cropping possibilities and alternative agricultural practices to help them diversify. This would help to determine obstacles, and would provide information for bankers and insurance companies so that new crops could be supported. Farmers mentioned that it is difficult to get insurance for a new crop. Farmers asked about the possibility of using ryegrass as a cover crop.

Suggestions for improving future discussion groups: Farmers would like future discussions to include all crops, not just an individual crop. The entire cropping system should be considered.

Small grains focus group questions

We asked attending farmers the following questions:

1. (part a) Looking back at your small grains farming operation over the past several years, what are the most important pest problems (weed, disease, and insect) that you have had to address?

   (part b) Were there any specific problems associated with reduced-till farming practices?

2. What specific pests do farmers need IPM practices for?

3. What IPM practices have you tried and liked, and why?

4. What IPM practices are not practical to use, and why?

5. What role should Extension and Research have in relation to IPM, and how can they better suit your needs?

Small grains focus group survey results

1. Counties in which you grow corn, soybean, or small grains (please check all that apply):
n = 7 farmers

County	No. of attending farmers with c/s/sg acreage in this county
Caroline	0
Charles City	0
Essex	0
King & Queen	3
King William	2
Lancaster	1
Middlesex	0
New Kent	2
Northumberland	2
Richmond	1
Westmoreland	1
Other--Gloucester	2
James City	1

2. Please indicate the approximate acreage you planted for each crop in the 2002 season.
n = 7 farmers (all attendees had corn, soybean, and small grain acreage)

Crop	Mean Acres Planted in 2002	Std. Dev.
Corn	616	371
Soybean	679	370
Small grains	321	313

3. How would you characterize your interest in integrated pest management (IPM)? Numbers in parentheses indicate the number of responses. **n = 7 farmers**

High interest (5)	Moderate interest (2)	Low interest (0)	No interest (0)

4. Where and how frequently do you get your information about IPM? Please check one box for each information source. **n = 7 farmers**

Information source	Often	Occasionally	Never
Internet		2	2
Extension agents	6	1	
Extension specialists	4	2	
Meetings/field days	4	3	
Other farmers	2	3	1
Chemical company representatives	1	4	1
Agricultural suppliers	1	3	2
Other—Self (reading)	1		

5. Please indicate your experience with the following topics by marking the appropriate box. Numbers indicate the number of responses for each category. **n = 8 farmers**

	Have heard of the practice/tool	Know someone who uses the practice/tool	Have tried the practice/tool but no longer use it	I use the practice/tool
WEEDS				
Scout for weeds	1	1		6
Electronic Weed ID Guide	5	1		1
Make site-specific herbicide applications	1	1		5
Cultural weed control such as cultivation		1	4	2
Keep all fields in a crop rotation clean				7
Make a map/keep a record of weed hotspots	1		1	3
Other				
DISEASES				
Select wheat cultivars resistant to barley yellow dwarf virus	2			6
Select wheat cultivars resistant to leaf rust	1			7
Select wheat cultivars resistant to powdery mildew	1			7
Rotate crops (avoid pathogens by not following wheat with wheat, or corn with wheat, to reduce risk from wheat scab and Septoria leaf and glume blotch)	1			7
Sanitation (bury infested crop residues such as corn stalks and wheat or grass stubble by tillage or plow) to reduce risk from wheat scab and Septoria leaf and glume blotch	2	1	3	2
Scouting and thresholds for powdery mildew	1			7
Scouting and thresholds for leaf and glume blotch		1		6
Other				
INSECTS				
Scouting for aphids and using thresholds to manage barley yellow dwarf virus				7
Scouting and thresholds for cereal leaf beetle	1			7
Scouting and thresholds for armyworm	1			7
Other				

SURVEY FINDINGS

The objective of the grower integrated pest management (IPM) survey was to gather information about why IPM practices are or are not being used on corn, soybean, and small grains farms in the coastal plains region of Virginia, and to develop strategies with Virginia Tech and Virginia Cooperative Extension to increase the implementation and adoption of specific under-utilized IPM practices by farmers. To meet this objective, an IPM questionnaire for each commodity was mailed to farmers in Virginia counties of Caroline, Charles City, Essex, King and Queen, King William, Lancaster, Middlesex, New Kent, Northumberland, Richmond, and Westmoreland. According to the United States Census of Agriculture, in 1997 these coastal plains counties harvested:

- 88,758 acres of corn
- 151,432 acres of soybean[1]
- 106,040 acres of small grains (wheat, barley, oats, and rye)

An underlying factor of IPM is minimizing pesticide usage. Therefore, increasing IPM adoption would enhance ground and surface water quality and reduce hazards to humans and wildlife. This would benefit the counties in which the IPM practices are used and the Chesapeake Bay watershed.

A general summary of survey findings is provided here for each commodity. Detailed results are given in the Appendix.

Survey questions were based on interviews with Virginia Tech Extension Specialists, input about IPM practices from Virginia Cooperative Extension Agriculture and Natural Resource (ANR) Agents, and three farmer IPM focus groups. A separate survey was designed for each commodity (corn, soybean, and small grains). Area ANR Agents provided names and addresses of farmers in their counties for mailings. The first mailing was sent during the first week of October 2002, and included a cover letter explaining the IPM project, a six-page survey of a single commodity, and a self-addressed, stamped return envelope. A reminder postcard was mailed two weeks later. A replacement survey was mailed to those who did not respond by the third week of October. Survey statistics and the crop acreage represented by the respondents are provided in Table 1.

Table 1. Survey statistics and crop acreage per respondent.

Commodity	No. of surveys distributed	Surveys returned (%)	Usable surveys (%)	Acreage Mean	Median
Corn	249	47.4	22.9	316	232
Soybean	249	46.2	25.7	439	329
Small grains	249	53.8	25.3	289	235

[1] 1992 United States Census of Agriculture data used for Westmoreland County.

Major Pests

Major weed, disease, and insect pests of corn, soybean, and small grains are indicated in Table 2. Morningglory was the most important weed pest in both corn and soybean. Italian ryegrass was most important in small grains. Powdery mildew was the number one disease of small grains, while disease appears to be less of a concern in corn and soybean. Corn growers indicated that the European corn borer was the most important insect pest in their crop. Corn earworm was the greatest insect problem for soybean growers, and cereal leaf beetle topped the list of small grains insect pests.

Table 2. Major crop pests in the coastal plains region of Virginia, as indicated by growers.

Commodity	Weeds		Diseases		Insects	
	Species	% [1]	Species	%	Species	%
Corn	Morningglory	70	Smut	32	European corn borer	46
	Pigweed	65	Gray leaf spot	28	White grub	37
	Italian ryegrass	49			Seedcorn maggot	33
	Johnsongrass	49			Cutworm	33
	Lambsquarters	49			Wireworm	32
	Honeyvine milkweed	49			Armyworm	30
Soybean	Morningglory	84	Purple seed stain	22	Corn earworm	80
	Lambsquarters	63	*Phytophthora*	13	Soybean looper	42
	Pigweed	55			Spider mite	33
					Armyworm	31
					Thrips	27
Small grains (wheat, barley, oats, rye)	Italian ryegrass	75	Powdery mildew	81	Cereal leaf beetle	79
	Wild garlic	67	Barley yellow dwarf	48	Aphid	68
	Chickweed	54	*Septoria*	40	Armyworm	24
	Henbit	44	Head scab	37		
	Vetch	43	Leaf rust	30		
	Cornflower	30				
	Johnsongrass	30				

[1] Percentage of grower surveys indicating the species as a pest.

Animal pests
Farmers were asked to rank the amount of damage to their crop caused by vertebrate animal pests on the scale: 1 = no economic damage, 2 = minor damage, 3 = moderate damage, 4 = major damage. We did not request dollar amounts or percentages of farm income for these categories. Mean damage ratings for animal pests are given in Table 3.

Table 3. Crop damage caused by vertebrate animal pests.

Commodity	Animal pest	n[1]	Mean rating[2]
Corn	Deer	50	2.5
	Crows	46	2.3
	Geese	46	1.8
Soybean	Deer	56	2.8
	Groundhogs	57	3.1
Small grains	Deer	52	2.5
	Geese	49	2.2
	Swans	41	1.5

[1] Number of responses for each questionnaire item.
[2] Mean of all responses for each questionnaire item, using a 1-4 scale where 1 = no economic damage and 4 = major
    damage.

IPM Practices Used and Not Used by Farmers

Summaries of findings for the separate corn, soybean, and small grains surveys are presented
below. Farmers were asked to rank their feelings and/or experiences on IPM-related topics on
the following scale: 1 = very false, 2 = somewhat false, 3 = somewhat true, 4 = very true.
Survey responses were averaged based on this 1-4 scale. Not all respondents answered each
questionnaire item. Means and the number of responses for each survey question are included in
the Appendix. Higher averages indicate higher agreement with a survey topic. Responses of 2.5
would be considered neutral; however, a "neutral" category was not listed on the survey. Lower
averages represent lower agreement with a survey topic. Means indicate the degree to which
farmers use an IPM practice. For this report, we considered IPM practices with mean ratings of
1.0-1.9 as "rarely used," ones with ratings of 2.0-2.9 as "sometimes used," and those averaging
3.0-4.0 as "often used." Reasons for use or non-use of IPM practices are included in the
discussion.

Corn

IPM practices often used (mean = 3.0-4.0)
- Farmer scouts for weeds and insects personally
- Using scouting to determine whether herbicide applications are needed
- Basing herbicide selection on weed scouting
- Use of scouting to manage weeds and diseases in future crop rotations
- Rotation of herbicide modes of action between crops
- Use of reduced-till or no-till practices
- Selection of disease-resistant corn varieties
- Farmer identification of cutworms, armyworms, and white grubs

IPM practices sometimes used (mean = 2.0-2.9)
- Farmer scouts for diseases personally
- Agricultural suppliers or chemical dealers scout for weeds, diseases, and insects for the farmer
- Making site-specific or variable-rate herbicide applications
- Farmer identification of wireworms
- Use of cutworm and armyworm thresholds
- Planting corn early to reduce risk from European corn borer
- Planting Bt corn to reduce risk from European corn borer if planting corn late

IPM practices rarely used (mean = 1.0-1.9)
- Extension Agents scout for weeds, diseases, and insects for the farmer
- Independent crop consultants scout for weeds, diseases, and insects for the farmer
- Use of cultivation to control weeds
- Making maps of weed hotspots in a field
- Use of bait stations to monitor wireworms
- Use of baited wire traps to monitor white grubs
- Digging and counting white grubs prior to planting corn

Soybean

IPM practices often used (mean = 3.0-4.0)
- Farmer scouts for weeds and insects personally
- Using scouting to determine whether herbicide applications are needed
- Basing herbicide selection on weed scouting
- Use of scouting to manage weeds and diseases in future crop rotations
- Rotation of herbicide modes of action between crops
- Use of reduced-till or no-till practices
- Use of rapid canopy closure to control weeds
- Farmer identification and use of thresholds for corn earworm

IPM practices sometimes used (mean = 2.0-2.9)
- Farmer scouts for diseases personally
- Agricultural suppliers or chemical dealers scout for weeds, diseases, and insects for the farmer
- Making site-specific or variable-rate herbicide applications
- Selection of disease-resistant soybean varieties
- Farmer associates nematodes with the diseases that they may cause

IPM practices rarely used (mean = 1.0-1.9)
- Extension Agents scout for weeds, diseases, and insects for the farmer
- Independent crop consultants scout for weeds, diseases, and insects for the farmer
- Use of cultivation to control weeds
- Making maps of weed hotspots in a field

Small grains

IPM practices often used (mean = 3.0-4.0)
- Farmer scouts for weeds, diseases, and insects personally
- Agricultural suppliers or chemical dealers scout for diseases and insects for the farmer
- Using scouting to determine whether herbicide applications are needed
- Basing herbicide selection on weed scouting
- Use of scouting to manage weeds and diseases in future crop rotations
- Rotation of herbicide modes of action between crops
- Use of reduced-till or no-till practices
- Selection of disease-resistant small grains varieties
- Farmer identification of cereal leaf beetles and aphids
- Use of thresholds for cereal leaf beetles and aphids

IPM practices sometimes used (mean = 2.0-2.9)
- Agricultural suppliers or chemical dealers scout for weeds for the farmer
- Extension Agents scout for weeds, diseases, and insects for the farmer
- Making site-specific or variable-rate herbicide applications

IPM practices rarely used (mean = 1.0-1.9)
- Independent crop consultants scout for weeds, diseases, and insects for the farmer
- Making maps of weed hotspots in a field

Use of IPM Internet resources

Survey participants were asked to indicate whether they used IPM resources available on the Internet. Links to these resources are available through Virginia Tech and Virginia Cooperative Extension. The corn earworm advisory is available through the Internet and local media. The percentage of farmers who used these resources is given in Table 4.

Table 4. Use of IPM Internet resources by farmers.

Commodity	IPM resource	n[1]	Usage (%)[2]
Corn	Virginia weed identification guide website (www.ppws.vt.edu/weedindex.htm)	53	13.2
	Virginia Insect Control Expert for Corn (VICE Corn) website (www.isis.vt.edu/~pbhogar/vicecorn.html)	53	1.9
Soybean	Virginia weed identification guide website	59	15.3
	Corn earworm advisory	58	55.2
	Corn earworm threshold calculator website (www.ipm.vt.edu/cew/)	64	4.7
Small grains	Virginia weed identification guide website	59	8.5

[1] Number of responses for each questionnaire item.
[2] Percentage of respondents indicating use of the IPM Internet resource.

DISCUSSION

Convincing farmers to adopt IPM programs is usually a slow process. The IPM programs must offer advantages over old methods. These programs should be economically feasible, offer incentives for their use, and must fit with current farming practices (Herbert, 1995). Current pest problems must be identified for development of appropriate IPM programs. Education, funding, and training are also necessary to ensure adoption of IPM practices. However, some IPM programs that meet all of these requirements may still not "catch on" with farmers. The IPM surveys helped us determine why this happens.

Reasons for use or non-use of IPM practices

Scouting
- Farmers personally scout their fields because they are concerned about pest problems and have confidence in their pest identification skills. Still, farmers mentioned a need for more education on scouting. Farmers indicated that it was "somewhat true" that they have adequate time to scout for weeds, diseases, and insects. Farmers did not think that scouting required too much walking, even though the mean age of farmers in the counties where this survey was conducted was 57 and the largest age group was age 65 or older (Fig. 1) (United States Census of Agriculture, 1997). Scouting weeds helps a farmer decide whether an herbicide application is needed, influences herbicide selection, and helps farmers manage weeds in future crop rotations.

Figure 1. Age structure of farm operators in 11 coastal plains counties in Virginia. (Source: 1997 United States Census of Agriculture)
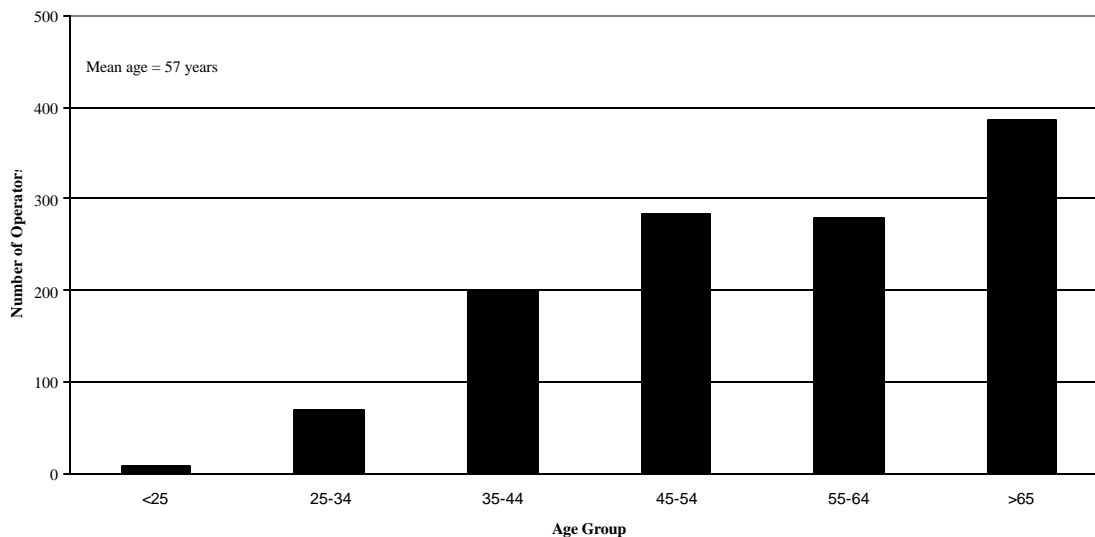
Use of thresholds
- Farmers can identify many insect pests and are generally aware that thresholds are available. Corn farmers sometimes use thresholds for cutworm and armyworm, but rarely use wireworm recommendations and white grub thresholds. Wireworm and white grubs are soil insect pests, which are difficult to observe, and monitoring them requires special traps and more effort than for other pests. However, farmers do not see the techniques as being too complicated. Monitoring white grubs by digging and counting is used more often than the baited wire trap technique, but still falls in the "rarely used" category. Soybean farmers often use corn earworm thresholds; this pest is the most important insect in soybean (Table 2). Farmers expressed confidence in corn earworm thresholds and considered them easy-to-use. Small grains farmers often used cereal leaf beetle and aphid thresholds for the same reasons.

- Thresholds for single weed species and species complexes do not exist. Therefore, each farmer will have his/her own tolerance level for weeds. It is recommended that farmers control weeds based on rotations, not single crops. For example, controlling a weed in one crop can prevent it from becoming a pest in a following crop. The same holds true for controlling certain insect and disease pests.

- Nematode assays were rarely performed in soybean fields. Average responses indicated that farmers did not know how to collect nematode samples and were not confident in their ability to associate nematodes with diseases. Practicality of taking samples, processing time by the nematode identification laboratory, and cost of the samples did not seem to be deterrents to having assays done. Farmers probably feel that nematode populations are held in check by use of nematode-resistant soybean varieties and crop rotation.

Information sources
- Farmers indicated that their fields were scouted more often by agricultural suppliers and/or chemical dealers than by ANR Agents or independent crop consultants. This appears to be a function of the number of people available in those positions; the more people available, the more farmland they can scout. Scouting promotes good relationships and earns farmers' trust, and this is important to all of these groups. A trusted person is one who serves as a farmer's information source. Product sales to the farmer are an additional motive for agricultural suppliers and chemical dealers to scout fields/serve as information sources.

- Technology could make scouting more efficient. Scouting from satellites or unmanned aircraft could reduce the amount of acreage that must be walked by the farmer. Survey respondents felt that it was somewhat important to develop this technology. The Internet offers pest identification guides, expert crop management systems, suggestions for managing pests, and pest advisories. Examples of these available online through Virginia Tech include the Virginia weed identification guide, VICE Corn, online pest management guides, the corn earworm threshold calculator, and the corn earworm advisory. However, farmers need training in order to use these resources. Many coastal plains farmers do not use Virginia Tech's online information (Table 4). The two most popular reasons for this were lack of awareness that the resource is available on the Internet and that they do not have computer access. Other reasons include use of other information sources, feeling uncomfortable using the computer, and not having Internet access. The corn earworm advisory had higher percent usage than other

Discussion

resources because it is available not only on the Internet, but also through local media. Soybean farmers value the advisory because it helps them decide when to begin scouting for their most important insect pest and helps them make management decisions.

- Farmers in the focus groups asked for a better way to diagnose disease symptoms, especially when symptoms first appear. Having *in situ* disease test kits available (in addition to current IPM information) may help accomplish this.

Tillage
- Reduced-till or no-till practices are popular in part because of associated reductions in erosion, increased soil quality, and compliance with conservation and nutrient management requirements. Since farmers want to maintain their reduced till/no-till land, they rarely cultivate for weed control. The few farmers who cultivated corn and soybean did not feel that it provided adequate weed control. Therefore, increasing cultivation is not a priority for researchers or Extension. Farmers should be very receptive to continuing promotion of reduced-till and no-till IPM practices.

Herbicide applications
- Herbicides are necessary to control weeds on lands where cultivation is not used. For example, Italian ryegrass is a widespread problem in no-till systems, and requires application of pesticides for its control. There is concern about pests such as this becoming herbicide resistant. Farmers are rotating herbicide modes of action between crops to reduce the risk of weeds becoming resistant. Also, they are making site-specific and/or variable-rate herbicide applications, thereby reducing chemical input compared to treating the entire field. Farmers mentioned that while treating the entire field would be easier and would likely give better weed control, making site-specific herbicide applications saves money (less chemicals required) and reduces wear and tear on equipment. Responses did not indicate that site-specific herbicide applications would affect the amount of time required to treat the field.

Mapping
- Farmers rarely make paper or computer-generated maps of weed hotspots in a field; regular scouting of their fields allows them to construct "mental maps" of these areas. However, it may be difficult to remember all problem areas season after season, especially when farming large or numerous tracts of land. It would be easier to get them to make paper maps than computer-generated maps, due to limited computer access and/or computer skills by some farmers.

Cultural practices
- Seed selection: Focus group farmers who planted glyphosate-resistant soybean indicated that they had few weed problems in their crop. However, surveys indicated that these farmers were still concerned about and scouted for weeds. Soybean diseases are not much of a concern to farmers in the coastal plains region of Virginia, while corn and small grains diseases are more of a concern. Following this trend, farmers indicted that they usually select disease-resistant corn and small grain varieties and sometimes select disease-resistant soybean varieties.

Farmers sometimes select Bt corn seed to reduce risk from European corn borer when planting late.

- Crop rotation: In the three farmer focus groups that we held in mid-July 2002, all 23 attendees farmed corn, soybean, and small grains crops. The survey indicated that farmers rotate crops to avoid weed, disease, and insect pests. They can maximize land usage and profitability by rotating crops; i.e., double-cropping soybean after small grains. Crop rotation also plays a role in nutrient management practices.

- Canopy development: Rapid soybean canopy development (through narrow row spacing and/or early planting) can help shade out weeds. Farmers have equipment capable of planting in narrow rows, and often use this IPM practice.

- Planting date: As mentioned above, early planting can help soybean achieve rapid canopy closure, thereby reducing weed pressure. Planting corn early reduces risk from European corn borer, a practice sometime done by coastal plains farmers.

- Reducing vertebrate animal pest damage: Deer, groundhogs, and birds damage crops (Table 3). Farmers may somewhat control these pests through hunting permits and exclusion techniques such as fencing. However, these are expensive and time-consuming options. Better control tactics are needed for these animal pests.

Seed treatments
- Farmers usually use fungicide-treated corn and small grains seed, and sometimes use fungicide-treated soybean seed. From the survey, farmers indicated that they have more moderate and major disease problems in corn and small grains than in soybean, which explains why fungicide seed treatments are more prevalent in corn and small grains. Seed treatments may reduce or eliminate the need for curative pesticide applications, and helps farmers feel that they are doing their best in managing their crops. However, preventive treatments should not be made in lieu of monitoring for pests, and seed treatments should be based on the field's pest history.

- Farmers sometimes use insecticide-treated corn seed, which may partly explain why there is such low monitoring of soil insect pests in corn using bait stations (for wireworms), baited wire traps (for white grubs), and/or digging and counting techniques (for white grubs). By using insecticide-treated corn seed, farmers may feel that it is unnecessary to monitor soil insect pests. However, using pesticides unnecessarily is a waste of money and is not an environmentally sound practice.

RECOMMENDATIONS

A workshop on constraints to IPM adoption for Illinois, Iowa, and Indiana corn and soybean producers indicated the need for more and better educated scouts (Sorensen, 1993). In our survey, Virginia farmers indicated a need for more education on scouting. It should be possible to train and have farmers become scouts for their own crops. Pest identification seminars would boost their knowledge and confidence. Scouts would need occasional "refresher" courses to keep aware of current pests and IPM practices. Technology may make scouting more efficient, provided proper user training.

The pest ranking of the soybean looper in the survey is an example of the need for more education. It was identified as the second most important insect pest of soybean (Table 2). However, an Extension Specialist stated that the soybean looper is rarely a problem in Virginia, and is often misidentified as green cloverworm. A green cloverworm eats only about half as much as a soybean looper, and therefore a plant can tolerate more green cloverworms than soybean loopers. Proper identification of these pests could prevent unnecessary pesticide usage.

Farmers need incentives to use IPM practices. There is a perception that preventive applications of pesticides are easier than spending time, labor, and management for IPM practices. It must be shown that IPM is profitable, or better yet, cheaper than traditional practices on farms of all sizes. The IPM practices must result in sustainable agriculture. A label specifying that a product used low or no pesticide input may encourage the use of IPM, provided that there is an associated economic benefit.

State highway crews and contractors should search for alternatives to planting Italian ryegrass, which is a major weed problem for corn and small grains farmers.

Research should be continued on developing pest-resistant corn, soybean, and small grain varieties. No plant is permanently resistant to a pest.

Thresholds for beneficial arthropods should be developed. Farmers may reduce their use of pesticides if they have a strong population of beneficials.

Research should be conducted on finding economical, legal, and humane ways to control wildlife pests such as deer, geese, and groundhogs.

Farmers want to know what constitutes "IPM," and need a specific list of these practices. Differences of opinion exist even among the experts as to how to classify levels of IPM adoption. Certainly the use of some IPM practices will be better for the environment than others. There will be "gray areas," such as using seed treatments or selective pesticides, where their use could prevent future "harsher" pesticide applications. Some researchers have used point values to indicate the relationship between practices and IPM (Hollingsworth et al., 1992). Others suggest weighing IPM practices proportionally to their importance (Fernandez-Cornejo and Jans, 1998). The United States Department of Agriculture classifies IPM usage as low, medium, and

high-level based on scouting, use of thresholds, and the use of additional equally weighted IPM practices.

IPM practices should be as efficient and user-friendly as possible. Farmers need help from experts and properly trained Extension personnel, independent crop consultants, agricultural suppliers, and/or chemical dealers. Communication between these parties is essential to providing farmers with timely and accurate information. Websites should be easy to find and navigate. Education on basic computer skills and use of technology would be helpful. There is still a need for hardcopy materials, especially a weed identification guide. When possible, local media should be used in addition to the Internet to provide users with information.

Corn farmers indicated that they look for soil insect pests when they check their planting depth more often than they use bait stations or baited wire traps. This could be an appropriate time for farmers to use the digging and counting technique.

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APPENDIX—Part 1: Cover letters and reminder postcards

Corn, soybean, and small grains surveys were mailed during the first week of October 2002. Cover letters accompanied all surveys. A reminder postcard was sent about one week later. A second cover letter and a replacement survey were sent to those who did not respond by the third week of October. The cover letter for the first mailing presented here was for soybean farmers; letters to corn and small grains farmers simply substituted the appropriate commodity name. Reminder postcards and second cover letters were identical for all three commodities.

A. First cover letter
B. Reminder postcard
C. Second cover letter

A. First cover letter (for soybean farmers)

Tidewater Agricultural Research and Extension Center
6321 Holland Road
Suffolk, VA 23437
phone: (757) 657-6450 ext. 122
email: herbert@vt.edu

September 30, 2002

Dear Sir or Madam:

Thank you for your cooperation in filling out this survey. We are affiliated with Virginia Tech, and are located at the Tidewater Agricultural Research and Extension Center in Suffolk, VA. We are working with your local Extension Agents to determine how we can improve the integrated pest management (IPM) practices available for you to use for your corn, soybean, and small grains crops. We held several Farmer discussion groups in Tappahannock and Glenns in July 2002, and listened to Farmers' opinions about IPM practices. Using information from these Farmer meetings, and also from Extension Specialists and Extension Agents, we drafted this survey. The information that you provide is critical to the success of the survey. **We greatly appreciate your time and thoughts.** Survey results will be provided to Extension Agents and we plan to have them published. We are sending farmers one of three surveys (corn, soybean, or small grains). In this survey, we are asking for your opinions about soybean.

We worked hard to make the survey straightforward. The information that you provide will not be used for any other purpose, and names will not be associated with any part of the survey. The number on the back of the survey is only to help us organize our mailings. If you have any questions about the survey, you may contact the survey director, Sean Malone, by phone at (757) 657-6450, extension 110, or by email: smalone@vt.edu. Please use the self-addressed stamped envelope to return the survey. Thank you, again, for your help and support with this effort.

Sincerely,

D. Ames Herbert, Jr.
Extension Entomologist

Survey Team:
Sean Malone, Research Associate, Tidewater AREC, Suffolk, VA
Susan Pheasant, Center for Agricultural Partnerships, Asheville, NC
Randy Shank, Nonpoint Educational Coordinator (retired), Dept. of Conservation and Recreation, Richmond, VA
Marc Aveni, Nonpoint Educational Coordinator, Dept. of Conservation and Recreation, Richmond, VA

B. Reminder postcard

Dear Sir or Madam:

Last week you should have received a questionnaire from us. If you have already completed and returned it, please accept our sincere thanks. If not, we ask that you do so as soon as possible. Your views will be very helpful as your Extension Agents and Specialists continue to work with farmers to implement and improve integrated pest management (IPM) tools and practices. If you did not receive the questionnaire, or if it was misplaced, please call us at 757-657-6450 extension 110, or email the Survey Director, Sean Malone, at smalone@vt.edu. We will then mail you another questionnaire. Thank you for your help.

D. Ames Herbert, Jr., Extension Entomologist

C. Second cover letter

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Tidewater Agricultural Research and Extension Center
6321 Holland Road
Suffolk, VA 23437
phone: (757) 657-6450 ext. 122
email: herbert@vt.edu

October 23, 2002

Dear Sir or Madam:

About three weeks ago, we wrote to you asking for your help as a commercial com, soybean, and/or small grains farmer to identify the integrated pest management (IPM) practices you are currently using and to prioritize those pest problems for which you would like IPM tools and solutions. As of today, we have not received your completed questionnaire. We hope you can take the time to complete it now, as your input is vital to the accuracy of the study.

The purpose of the study is to identify and thereby support the people, resources, and tools you utilize as you implement IPM practices in your farming operation. The survey focuses on the major pest problems you face and the IPM solutions and tools you currently have and/or want to have available in the future. As a farmer working with IPM issues, you are in a unique position to furnish this information and to also identify key areas for additional information, education, and support for your farming operation.

A replacement questionnaire and stamped return envelope are enclosed for your convenience. Your participation is voluntary; however, hearing from all of the farmers selected for this study is important so that the survey results will be able to represent all types of farmers in the coastal plains of Virginia. Results will be made available through your local Extension Agent.

The returns so far are encouraging. The results should provide a comprehensive picture of the significant pests and the IPM tools and practices used and needed to address significant weed, disease, insect, and animal pest issues.

If you have any questions about the study, please feel free to contact the survey director, Sean Malone, by email (smalone@vt.edu) or by phone at (757) 657-6450 ext 110. Thank you for your help.

Sincerely,

D. Ames Herbert, Jr.
Extension Entomologist

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APPENDIX—Part 2: Questionnaires used in the survey

Questionnaires were sent to 249 individuals per commodity during the first week of October 2002. The names and addresses were obtained through local ANR Agents. A cover letter and a self-addressed, stamped return envelope were included with the questionnaires. A replacement questionnaire, second cover letter, and a self-addressed, stamped return envelope were sent to those who did not respond by the third week of October.

Section A: Corn survey
Section B: Soybean survey
Section C: Small grains survey

A. Survey of Corn Farmers in the Coastal Plains Region of Virginia

Part I. Background Information

1. Please indicate how many acres of corn you grew in 2002: _____ acres
(If you did <u>not</u> grow any corn in 2002, please check here: _____ and note that your survey is complete. Please return your survey in the enclosed envelope.)

2. Please place a check mark next to all Virginia counties in which you grew corn in 2002.

County		County		County	
Caroline		King & Queen		New Kent	
Charles City		King William		Northumberland	
Essex		Lancaster		Richmond	
Gloucester		Mathews		Westmoreland	
James City		Middlesex		Other (please list)	

Part II. Weeds In Corn

We would like to ask you some questions about weed pests and practices in corn.

3. First, please circle <u>all</u> weeds that are moderate or major pests in your cornfields:

Annual (Italian) ryegrass	Trumpetcreeper	Shattercane
Honeyvine milkweed	Hemp dogbane	Morningglory
Mugwort/wild chrysanthemum	Horsenettle	Lambsquarters
Japanese bamboo	Johnsongrass	Pigweed
Other (please list)_____		

Next, please check one box per line that indicates your feelings or experiences on the following weed-related topics.

4. SCOUTING FOR WEEDS	Very True	Somewhat True	Somewhat False	Very False	Not Applicable
A. I am concerned about weed problems in corn					
B. I am confident in my weed identification skills					
C. I have adequate time to scout for weeds					
D. Scouting for weeds requires too much walking					
E. I personally scout for weeds in my corn					
F. An Extension Agent scouts my corn for weeds					
G. An independent crop consultant scouts my corn for weeds					
H. An agricultural supplier or agricultural chemical dealer scouts my corn for weeds					
I. Scouting weeds helps me decide whether a herbicide application is needed in my corn					
J. Scouting weeds influences my choice of herbicide					
K. Scouting helps me control/manage weeds in future crops					
L. Scouting weeds helps me incorporate variable-rate/site-specific spray technologies on my farm					

5. HERBICIDE APPLICATIONS	Very True	Somewhat True	Somewhat False	Very False	Not Applicable
A. I rotate herbicide modes of action between my crops to reduce the risk of herbicide-resistant weeds					
B. I make site-specific or variable-rate herbicide applications					
C. It is easier to treat the entire field, rather than make site-specific herbicide applications					
D. Treating the entire field gives better weed control than site-specific applications					
E. Making site-specific herbicide applications saves money					
F. Making site-specific herbicide applications reduces wear and tear on equipment					
G. Making site-specific herbicide applications saves time					

6. CULTIVATION	Very True	Somewhat True	Somewhat False	Very False	Not Applicable
A. I cultivate to control weeds in corn (if you do not cultivate, please mark "very false," and skip to question "E")					
B. Cultivation is cost-effective					
C. I cultivate to reduce the number of chemical applications in my corn					
D. Cultivation adequately controls weeds in my corn					
E. I rely more on herbicides than cultivation to control weeds in corn					
F. Corn gets too tall for me to cultivate effectively					
G. I use reduced-till or no-till practices on my farm					

7. MAPPING	Very True	Somewhat True	Somewhat False	Very False	Not Applicable
A. I make paper or computer maps of weed hotspots in my cornfields					
B. Making paper or computer maps of weed hotspots is practical					
C. I make mental maps of weed hotspots in my cornfields					
D. Mapping weed hotspots helps me manage weeds in future crops					
E. Mapping weed hotspots helps me incorporate variable-rate or site-specific spray technology					

Part III. Diseases In Corn

In this section, we would like to ask you about diseases in your corn.

8. First, please circle all diseases that are moderate or major problems in your cornfield:

Smut   *Fusarium*   Mosaic dwarf
Gray leaf spot   Other (please list)_____

Next, please check one box per line that indicates your feelings or experiences on the following disease-related topics.

9. DISEASE	Very True	Somewhat True	Somewhat False	Very False	Not Applicable
A. I am concerned about disease problems in corn					
B. I am confident in my disease identification skills					
C. I have adequate time to scout for diseases					
D. Scouting diseases requires too much walking					
E. I scout for diseases in my corn					
F. An Extension Agent scouts my corn for diseases					
G. An independent crop consultant scouts my corn for diseases					
H. An agricultural supplier or agricultural chemical dealer scouts my corn for diseases					
I. I select corn seed treated with fungicides					
J. I select disease-resistant corn varieties					
K. Scouting for diseases helps me decide if I need to rotate future crops to avoid diseases					

Part IV. Insects In Corn

In this section, we would like to ask you about insect pests in your corn.

10. First, please circle all insects that are moderate or major problems in your cornfield:

European corn borer	Armyworms	Wireworms	White grubs
Seedcorn maggot	Cutworms	Grasshoppers	Corn rootworms
Japanese beetles	Snails/slugs	Billbugs	Stalk borer
Corn root aphids	Other (please list)_____		

Next, please check one box per line that indicates your feelings or experiences on the following insect-related topics.

11. SCOUTING FOR INSECTS	Very True	Somewhat True	Somewhat False	Very False	Not Applicable
A. I personally scout my corn for insects					
B. An Extension Agent scouts my corn for insects					
C. An independent crop consultant scouts my corn for insects					
D. An agricultural supplier or agricultural chemical dealer scouts my corn for insects					
E. Scouting for insects requires too much time					
F. Scouting for insects requires too much walking					
G. Scouting for insects costs too much					

12. CUTWORMS	Very True	Somewhat True	Somewhat False	Very False	Not Applicable
A. I can identify cutworms					
B. I am aware that cutworm thresholds are available					
C. I use thresholds for cutworms in corn					
D. Cutworm thresholds are easy to use					
E. I have confidence in the cutworm thresholds					
F. I have time to scout for cutworms					
G. I apply insecticides for cutworm control					

13. EUROPEAN CORN BORER	Very True	Somewhat True	Somewhat False	Very False	Not Applicable
A. I plant corn early to reduce risk from European corn borer					
B. I plant Bt corn to reduce risk from European corn borer if I plant after May 15					

14. ARMYWORMS	Very True	Somewhat True	Somewhat False	Very False	Not Applicable
A. I can identify armyworms					
B. I am aware that armyworm thresholds are available					
C. I use thresholds for armyworms in corn					
D. Armyworm thresholds are easy to use					
E. I have confidence in the armyworm thresholds					
F. I have time to scout for armyworms					
G. I apply insecticides for armyworm control					

15. WIREWORMS	Very True	Somewhat True	Somewhat False	Very False	Not Applicable
A. I can identify wireworms					
B. I have heard of monitoring wireworms using bait stations					
C. I use bait stations to monitor wireworms in corn					
D. I have time to monitor wireworms					
E. Monitoring wireworms with bait stations is practical					
F. I have confidence in the recommendations based on bait station wireworm captures					
G. Wireworm thresholds are too complicated					
H. I apply seed treatments or in-furrow insecticides for wireworms					

16. WHITE GRUBS	Very True	Somewhat True	Somewhat False	Very False	Not Applicable
A. I can identify white grubs					
B. I have heard of monitoring white grubs using baited wire traps					
C. I use baited wire traps to monitor white grubs in corn					
D. I have time to monitor white grubs using baited wire traps					
E. Monitoring white grubs with baited wire traps is practical					
F. I have confidence in the white grub thresholds based on baited wire traps					
G. White grub thresholds are too complicated					
H. I apply seed treatments or in-furrow insecticides for white grubs and other corn seed pests					
I. I have heard about thresholds based on using a shovel to dig and count white grubs prior to planting corn					
J. I dig and count white grubs before planting corn					
K. I have time to sample for white grubs using the digging technique					
L. I have confidence in the thresholds based on digging and counting white grubs before planting corn					
M. I check for corn seed pests when I check my planting depth					

Part V. Animals In Corn

17. Please check one box per line that indicates how much economic damage, if any, each of the following animals cause in your corn.

	No economic damage	Minor damage	Moderate damage	Major damage	Unsure
A. Deer					
B. Crows					
C. Geese					

Part VI. Corn IPM Tools

18. Please check one box per line that indicates your feelings and/or experiences on the following topics.

	Very True	Somewhat True	Somewhat False	Very False	Not Applicable
A. It is important to develop remote sensing tools, such as satellite photographs, to help scout weeds, diseases, and insects in corn					
B. Integrated Pest Management (IPM) is important					
C. I need more education on weed scouting					
D. I need more education on disease scouting					
E. I need more education on insect scouting					

Finally, please answer the following two questions concerning your use of IPM Internet resources.

19. Have you used the Virginia weed ID guide website? (www.ppws.vt.edu/weedindex.htm)
   A. Yes
   B. No

   If you answered "No," why haven't you used it? Please circle all that apply.
   a. Never heard of it
   b. No access to a computer
   c. I feel uncomfortable using the computer
   d. I went to the website, but the weed ID guide did not answer my questions
   e. I already know my weed species
   f. I use another weed identification source
   g. Other reasons why I do not use the website (please specify): _____

   If you answered "Yes," why have you used it? Please circle all that apply.
   a. Ease of use
   b. Adequately covers the weeds that I encounter
   c. I have confidence in the weed ID guide
   d. Other reasons why I use the website (please specify): _____

20. Have you used the Virginia Insect Control Expert for Corn (VICE Corn) website?
(www.isis.vt.edu/~pbhogar/vicecorn.html)
   A. Yes
   B. No

   If you answered "No," why haven't you used it? Please circle all that apply.
   a. Never heard of it
   b. No access to a computer
   c. I am uncomfortable using a computer
   d. I went to the VICE Corn website, but it did not answer my questions
   e. I went to the VICE Corn website, but did not have confidence in it
   f. Other reasons why I do not use the website (please specify): _____

   If you answered "Yes," why have you used it? Please circle all that apply.
   a. Ease of use
   b. Adequately covers the pests that I encounter
   c. I have confidence in the VICE Corn website
   d. Other reasons why I use the website (please specify): _____

Thank you for filling out this questionnaire! If you have comments about the questionnaire, please feel free to write them below.

Please return your completed questionnaire to:
Sean Malone, Tidewater AREC, 6321 Holland Road, Suffolk, VA 23437

B. Survey of Soybean Farmers in the Coastal Plains Region of Virginia

Part I. Background Information

1. Please indicate how many acres of soybean you grew in 2002: _____acres
(If you did <u>not</u> grow any soybean in 2002, please check here: _____ and note that your survey is complete. Please return your survey in the enclosed envelope.)

2. Please place a check mark next to all Virginia counties in which you grew soybean in 2002.

County		County		County	
Caroline		King & Queen		New Kent	
Charles City		King William		Northumberland	
Essex		Lancaster		Richmond	
Gloucester		Mathews		Westmoreland	
James City		Middlesex		Other (please list)	

Part II. Weeds in Soybean

We would like to ask you some questions about weed pests and practices in soybean.

3. First, please circle <u>all</u> weeds that are moderate or major pests in your soybean fields:

Marestail/horseweed   Lambsquarters   Pigweed
Hemp dogbane   Morningglory   Other (please list)_____

Next, please check one box per line that indicates your feelings or experiences on the following weed-related topics.

4. SCOUTING FOR WEEDS	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. I am concerned about weed problems in my soybean					
B. I am confident in my weed identification skills					
C. I have adequate time to scout for weeds					
D. Scouting for weeds requires too much walking					
E. I personally scout for weeds in my soybean					
F. An Extension Agent scouts my soybean for weeds					
G. An independent crop consultant scouts my soybean for weeds					
H. An agricultural supplier or agricultural chemical dealer scouts my soybean for weeds					
I. Scouting weeds helps me decide whether a herbicide application is needed in my soybean					
J. Scouting weeds influences my choice of herbicide					
K. Scouting helps me control/manage weeds in future crops					
L. Scouting weeds helps me incorporate variable-rate or site-specific spray technologies on my farm					

5. HERBICIDE APPLICATIONS	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. I rotate herbicide modes of action between my crops to reduce the risk of herbicide-resistant weeds					
B. I make site-specific or variable-rate herbicide applications in soybean					
C. It is easier to treat the entire soybean field, rather than make site-specific applications					
D. Treating the entire soybean field gives better weed control than making site-specific herbicide applications					
E. Making site-specific herbicide applications saves money					
F. Making site-specific herbicide applications reduces wear and tear on equipment					
G. Making site-specific herbicide applications saves time					

6. CULTIVATION	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. I cultivate to control weeds in soybean (if you do not cultivate, please mark "very false," and skip to question "E")					
B. Cultivation is cost-effective					
C. I cultivate to reduce the number of chemical applications in my soybean					
D. Cultivation adequately controls weeds in my soybean					
E. I rely more on herbicides than cultivation to control weeds in soybean					
F. Soybean gets too tall for me to cultivate effectively					
G. I use reduced-till or no-till practices on my farm					

7. MAPPING	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. I make paper or computer maps of weed hotspots in my soybean fields					
B. Making paper or computer maps of weed hotspots is practical					
C. I make mental maps of weed hotspots in my soybean fields					
D. Mapping weed hotspots helps me manage weeds in future crops					
E. Mapping weeds hotspots helps me incorporate variable-rate or site-specific spray technology					

8. CULTURAL WEED CONTROL	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. I use rapid canopy closure (through narrow row spacing and/or early planting) to help shade out weeds in my soybean					
B. My equipment is capable of planting in narrow rows					
C. I have confidence in using rapid canopy closure to control weeds in soybean					

Part III. Diseases in Soybean

In this section, we would like to ask about diseases in your soybean.

9. First, please circle all diseases that are moderate or major problems in your soybean field:

Fusarium/Pythium damping-off   *Phomopsis* seed decay   *Phytophthora* root rot
Soybean mosaic virus   Purple seed stain   Peanut mottle virus
Bean pod mottle virus   Charcoal rot   Red crown rot
Pod and stem blight   Anthracnose   Brown stem rot
Brown spot   Downy mildew   Frogeye
Root knots   Other (please list)_____

Next, please check one box per line that indicates your feelings or experiences on the following disease-related topics.

10. DISEASE	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. I am concerned about disease problems in my soybean					
B. I am confident in my disease identification skills					
C. I have adequate time to scout for diseases					
D. Scouting for diseases requires too much walking					
E. I scout for diseases in my soybean					
F. An Extension Agent scouts my soybean for diseases					
G. An independent crop consultant scouts my soybean for diseases					
H. An agricultural supplier or agricultural chemical dealer scouts my soybean for diseases					
I. I select soybean seed treated with fungicides					
J. I select disease-resistant soybean varieties					
K. Scouting helps me decide if I need to rotate future crops to avoid diseases					

11. How often do you have nematode assays performed on your soybean fields? Please circle one answer.
a. Every year
b. Every two or three years
c. Every four or more years
d. I've never had a nematode assay performed on my soybean fields

Please check one box per line that indicates your feelings or experiences on nematodes.

12. NEMATODES	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. Nematodes are a problem in my soybean					
B. I can associate nematodes with the diseases that they cause					
C. I know how to take nematode samples					
D. Collecting nematode samples is practical					
E. I do not do predictive nematode assays because they are too expensive					
F. It takes too long to receive nematode test results from the lab					
G. I rotate crops to reduce risk from nematodes					
H. I use nematode-resistant soybean varieties					
I. In the long run, performing nematode assays saves me money					

Part IV. Insects in Soybean

In this section, we would like to ask about insect pests in your soybean.

13. First, please circle all insects that are moderate or major problems in your soybean field:

Mexican bean beetle	Corn earworm	Green cloverworm
Potato leafhopper	Thrips	Spider mite
Grasshopper	Armyworm	Stink bug
Soybean looper	Other (please list)_____	

Next, please check one box per line that indicates your feelings or experiences on the following insect-related topics.

14. SCOUTING FOR INSECTS	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. I personally scout my soybean for insects					
B. An Extension Agent scouts my soybean for insects					
C. An independent crop consultant scouts my soybean for insects					
D. An agricultural supplier or agricultural chemical dealer scouts my soybean for insects					
E. Scouting for insects requires too much time					
F. Scouting for insects requires too much walking					
G. Scouting for insects costs too much					

15. CORN EARWORM	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. I can identify corn earworms					
B. I am aware that corn earworm thresholds are available					
C. I use thresholds for corn earworm in soybean					
D. Corn earworm thresholds are easy to use					
E. I have confidence in the corn earworm thresholds					
F. I have time to scout for corn earworm					
G. I apply insecticides for corn earworm control					

Part V. Animals

16. Please check one box per line that indicates how much economic damage, if any, each of the following animals cause in your soybean.

	No economic damage	Minor damage	Moderate damage	Major damage	Unsure
A. Deer					
B. Groundhogs					

Part VI. Soybean IPM Tools

17. Please check one box per line that indicates your feelings and/or experiences on the following topics.

	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. It is important to develop remote sensing tools, such as satellite photographs, to help scout weeds, diseases, and insects in soybean					
B. Integrated Pest Management (IPM) is important					
C. I need more education on weed scouting					
D. I need more education on disease scouting					
E. I need more education on insect scouting					
F. Monitoring soybean fields for herbicide-resistant weeds is important					
G. Research should be done to determine thresholds for beneficial organisms in soybean					

Finally, please answer the following three questions concerning your use of IPM resources.

18. Have you used the Virginia weed ID guide website? (www.ppws.vt.edu/weedindex.htm)
> a. Yes
> b. No
>
> **If you answered "No," why haven't you used it? Please circle all that apply.**
> a. Never heard of it
> b. No access to a computer
> c. I feel uncomfortable using the computer
> d. I went to the website, but the weed ID guide did not answer my questions
> e. I already know my weed species
> f. I use another weed identification source
> g. Other reasons (please specify): _____
>
> **If you answered "Yes," why have you used it? Please circle all that apply.**
> a. Ease of use
> b. Adequately covers the weeds that I encounter
> c. I have confidence in the weed ID guide
> d. Other reasons (please specify): _____

19. Have you used the corn earworm threshold calculator on the Internet?
(www.ipm.vt.edu/cew/)
> a. Yes
> b. No

> **If you answered "No," why haven't you used it? Please circle all that apply.**
> a. Never heard of it
> b. No access to a computer
> c. I am uncomfortable using a computer
> d. I went to the website, but it did not answer my questions
> e. The calculator did not represent my row spacing
> f. The calculator did not represent my sampling technique
> g. I use a hard-copy version of the corn earworm thresholds
> h. Other reasons (please specify): _____

> **If you answered "Yes," why have you used it? Please circle all that apply.**
> a. Ease of use
> b. Adequately represents my row spacing
> c. Adequately represents my sampling technique
> d. I have confidence in the thresholds
> e. Other reasons (please specify): _____

20. Do you use the corn earworm advisory?
> a. Yes
> b. No

> **If "No," why don't you use the corn earworm advisory?**
> a. Never heard of it
> b. It is not published in my local media
> c. I do not have confidence in the advisory
> d. I do not understand the advisory
> e. Other reasons (please specify): _____

> **If "Yes," why do you use the corn earworm advisory?**
> a. I use it to help make management decisions in my soybean
> b. It helps me decide when to begin scouting for corn earworm in my soybean
> c. I have confidence in the advisory
> d. It is easy to understand
> e. It is readily available
> f. Other reasons (please specify): _____

Thank you for taking the survey! If you have comments about the questionnaire, please feel free to write them below.

Please return your completed questionnaire to:
Sean Malone, Tidewater AREC, 6321 Holland Road, Suffolk, VA 23437

C. Survey of Small Grains Farmers in the Coastal Plains Region of Virginia

Part I. Background Information

1. Please indicate how many acres of small grains (wheat, barley, oats, and/or rye) you grew in 2001/2002: _____acres

(If you did <u>not</u> grow any small grains in 2001/2002, please check here: _____ and note that your survey is complete. Please return your survey in the enclosed envelope.)

2. Please place a check mark next to all Virginia counties in which you grew small grains in 2001/2002.

County		County		County	
Caroline		King & Queen		New Kent	
Charles City		King William		Northumberland	
Essex		Lancaster		Richmond	
Gloucester		Mathews		Westmoreland	
James City		Middlesex		Other (please list)	

Part II. Weeds in Small Grains

We would like to ask you some questions about weed pests and practices in small grains.

3. First, please circle <u>all</u> weeds that are moderate or major pests in your small grains fields:

Annual (Italian) ryegrass   Speedwell   Wild garlic/onions
Cornflower/bachelor's buttons   Poanna   Vetch
Tall meadow oat grass   Henbit   Chickweed
Mugwort/wild chrysanthemum   Johnsongrass   Virginia creeper
Honeyvine milkweed   Little barley   Canadian thistle
Common milkweed   Marestail/horseweed
Other (please list)_____

Next, please check one box per line that indicates your feelings or experiences on the following weed-related topics.

4. SCOUTING FOR WEEDS	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. I am concerned about weed problems in my small grains					
B. I am confident in my weed identification skills					
C. I have adequate time to scout for weeds					
D. Scouting for weeds requires too much walking					
E. I personally scout for weeds in my small grains					
F. An Extension Agent scouts my small grains for weeds					
G. An independent crop consultant scouts my small grains for weeds					

SCOUTING FOR WEEDS (continued)	Very true	Somewhat true	Somewhat false	Very false	Not applicable
H. An agricultural supplier or agricultural chemical dealer scouts my small grains for weeds					
I. Scouting weeds helps me decide whether a herbicide application is needed in my small grains					
J. Scouting weeds influences my choice of herbicide					
K. Scouting helps me control/manage weeds in future crops					
L. Scouting weeds helps me incorporate variable-rate/site-specific spray technologies on my farm					

5. HERBICIDE APPLICATIONS	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. I rotate herbicide modes of action between my crops to reduce the risk of herbicide-resistant weeds					
B. I make site-specific or variable-rate herbicide applications in small grains					
C. It is easier to treat the entire small grains field, rather than make site-specific applications					
D. Treating the entire small grains field gives better weed control than making site-specific herbicide applications					
E. Making site-specific herbicide applications saves money					
F. Making site-specific herbicide applications reduces wear and tear on equipment					
G. Making site-specific herbicide applications saves time					

6. CULTIVATION	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. I cultivate to control weeds in small grains (if you do not cultivate, please mark "very false," and skip to question "E")					
B. Cultivation is cost-effective					
C. I cultivate to reduce the number of chemical applications in my small grains					
D. Cultivation adequately controls weeds in my small grains					
E. I rely more on herbicides than cultivation to control weeds in small grains					
F. Small grains get too tall for me to cultivate effectively					
G. I use reduced-till or no-till practices on my farm					

7. MAPPING	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. I make paper or computer maps of weed hotspots in my small grains fields					
B. Making paper or computer maps of weed hotspots is practical					
C. I make mental maps of weed hotspots in my small grains fields					
D. Mapping weed hotspots helps me manage weeds in future crops					
E. Mapping weed hotspots helps me incorporate variable-rate or site-specific spray technology					

Part III. Diseases in Small Grains

In this section, we would like to ask you about diseases in your small grains.

8. First, please circle all diseases that are moderate or major problems in your small grains field:

Septoria leaf and glume blotch   Head scab   Powdery mildew
Spindle-streak mosaic virus   Leaf rust   Take-all
Barley yellow dwarf virus   Other (please list)_____

Next, please check one box per line that indicates your feelings or experiences on the following disease-related topics.

9. DISEASE	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. I am concerned about disease problems in my small grains					
B. I am confident in my disease identification skills					
C. I have adequate time to scout for diseases					
D. Scouting for diseases requires too much walking					
E. I scout for diseases in my small grains					
F. An Extension Agent scouts my small grains for diseases					
G. An independent crop consultant scouts my small grains for diseases					
H. An agricultural supplier or agricultural chemical dealer scouts my small grains for diseases					
I. I select small grains seed treated with fungicides					
J. I select disease-resistant small grains varieties					
K. Scouting helps me decide if I need to rotate future crops to avoid diseases					

Part IV. Insects in Small Grains

In this section, we would like to ask you about insect pests in your small grains.

10. First, please circle all insects that are moderate or major problems in your small grains field:

Cereal leaf beetle   Aphids   Hessian fly

Armyworm   Thrips   Stink bugs

Grasshoppers   Other (please list)_____

Next, please check one box per line that indicates your feelings or experiences on the following insect-related topics.

11. SCOUTING FOR INSECTS	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. I personally scout my small grains for insects					
B. An Extension Agent scouts my small grains for insects					
C. An independent crop consultant scouts my small grains for insects					
D. An agricultural supplier or agricultural chemical dealer scouts my small grains for insects					
E. Scouting for insects requires too much time					
F. Scouting for insects requires too much walking					
G. Scouting for insects costs too much					

12. CEREAL LEAF BEETLE	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. I can identify cereal leaf beetles					
B. I am aware that cereal leaf beetle thresholds are available					
C. I use thresholds for cereal leaf beetles in small grains					
D. Cereal leaf beetle thresholds are easy to use					
E. I have confidence in cereal leaf beetle thresholds					
F. I have time to scout for cereal leaf beetle					
G. I apply insecticides for cereal leaf beetle control					

13. APHIDS	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. I can identify aphids					
B. I am aware that aphid thresholds are available					
C. I use thresholds for aphids in small grains					
D. Aphid thresholds are easy to use					
E. I have confidence in the aphid thresholds					
F. I have time to scout for aphids					
G. I apply insecticides for aphid control					

Part V. Animals

14. Please check one box per line that indicates how much economic damage, if any, each of the following animals cause in your small grains.

	No economic damage	Minor damage	Moderate damage	Major damage	Unsure
A. Deer					
B. Geese					
C. Swans					

Part VI. Small Grains IPM Tools

15. Please check one box per line that indicates your feelings and/or experiences on the following topics.

	Very true	Somewhat true	Somewhat false	Very false	Not applicable
A. It is important to develop remote sensing tools, such as satellite photographs, to help scout weeds, diseases, and insects in small grains					
B. Integrated Pest Management (IPM) is important					
C. I need more education on weed scouting					
D. I need more education on disease scouting					
E. I need more education on insect scouting					
F. I need more education on differentiating between nutrient deficiencies and diseases in small grains					
G. More research should be done on developing genetically "tougher" and pest-resistant small grain varieties					
H. More research should be done on developing earlier-maturing small grains cultivars					
I. I need more educational programs on using a computer					
J. I need more educational programs about taking and electronically sending digital photographs					

(please turn the page)

Finally, please answer the following question concerning your use of an IPM Internet resource.

16. Have you used the Virginia weed ID guide website? (www.ppws.vt.edu/weedindex.htm)
        a. Yes
        b. No

        If you answered "No," why haven't you used it? Please circle all that apply.
        a. Never heard of it
        b. No access to a computer
        c. I feel uncomfortable using the computer
        d. I went to the website, but the weed ID guide did not answer my questions
        e. I already know my weed species
        f. I use another weed identification source
        g. Other reasons (please specify): _____

        If you answered "Yes," why have you used it? Please circle all that apply.
        a. Ease of use
        b. Adequately covers the weeds that I encounter
        c. I have confidence in the weed ID guide
        d. Other reasons (please specify): _____

Thank you for taking the survey! If you have comments about the questionnaire, please feel free to write them in the box below.

<div align="center">
Please return your completed questionnaire to:
Sean Malone, Tidewater AREC, 6321 Holland Road, Suffolk, VA 23437
</div>

Comments:

APPENDIX—Part 3: Corn, soybean, and small grains survey responses

A summary of survey responses is presented in the following sections:

A. Corn
B. Soybean
C. Small grains

Each summary is divided into the following subsections:

(i) Counties where survey participants farm.

(ii) Mean responses to questionnaire items that were based on a 1-4 scale, where 1 = very false and 4 = very true. The number of responses is given because not all respondents answered each questionnaire item.

(iii) Weed pests.

(iv) Disease pests.

(v) Insect and other non-vertebrate pests.

(vi) Vertebrate pests.

(vii) Internet IPM resources.

APPENDIX—Part 3-A: Corn survey responses

Fifty-seven of the 249 corn surveys distributed were usable (22.9%). Survey responses, including write-in responses, are included in parts i-vii. Average corn acreage grown in 2002 was 316.3 acres per respondent (median = 232.0 acres).

3-A (i). Virginia counties in which participants grew corn in 2002 (n = 57).

County	Number of respondents growing corn in this county	Percent of total
Caroline	8	14.0
Charles City	0	---
Essex	8	14.0
Gloucester	3	5.3
James City	0	---
King & Queen	2	3.5
King William	3	5.3
Lancaster	10	17.5
Mathews	1	1.8
Middlesex	2	3.5
New Kent	1	1.8
Northumberland	16	28.1
Richmond	9	15.8
Westmoreland	9	15.8
Write-ins		
Hanover	1	1.8

3-A (ii). Responses to questionnaire items by farmers about corn IPM

Questionnaire topic	n[1]	Mean rating[2]
SCOUTING FOR WEEDS		
A. I am concerned about weed problems in corn	56	3.6
B. I am confident in my weed identification skills	53	3.0
C. I have adequate time to scout for weeds	53	2.8
D. Scouting for weeds requires too much walking	51	2.0
E. I personally scout for weeds in my corn	53	3.3
F. An Extension Agent scouts my corn for weeds	44	1.4
G. An independent crop consultant scouts my corn for weeds	36	1.4
H. An agricultural supplier or agricultural chemical dealer scouts my corn for weeds	50	2.5
I. Scouting weeds helps me decide whether a herbicide application is needed in my corn	53	3.6
J. Scouting weeds influences my choice of herbicide	55	3.7
K. Scouting helps me control/manage weeds in future crops	55	3.7
L. Scouting weeds helps me incorporate variable-rate/site-specific spray technologies on my farm	49	3.0
HERBICIDE APPLICATIONS		
A. I rotate herbicide modes of action between my crops to reduce the risk of herbicide-resistant weeds	52	3.3
B. I make site-specific or variable-rate herbicide applications	49	2.7

C. It is easier to treat the entire field, rather than make site-specific herbicide applications	52	3.1
D. Treating the entire field gives better weed control than site-specific applications	50	3.0
E. Making site-specific herbicide applications saves money	48	3.2
F. Making site-specific herbicide applications reduces wear and tear on equipment	45	3.0
G. Making site-specific herbicide applications saves time	47	2.5

CULTIVATION

A. I cultivate to control weeds in corn (if you do <u>not</u> cultivate, please mark "very false," and skip to question "E")	51	1.4
B. Cultivation is cost-effective	10	2.8
C. I cultivate to reduce the number of chemical applications in my corn	10	2.1
D. Cultivation adequately controls weeds in my corn	9	2.3
E. I rely more on herbicides than cultivation to control weeds in corn	43	3.7
F. Corn gets too tall for me to cultivate effectively	28	2.5
G. I use reduced-till or no-till practices on my farm	44	3.7

MAPPING

A. I make paper or computer maps of weed hotspots in my cornfields	48	1.4
B. Making paper or computer maps of weed hotspots is practical	46	2.4
C. I make mental maps of weed hotspots in my cornfields	48	3.3
D. Mapping weed hotspots helps me manage weeds in future crops	45	3.0
E. Mapping weed hotspots helps me incorporate variable-rate or site-specific spray technology	44	2.4

DISEASE

A. I am concerned about disease problems in corn	48	3.1
B. I am confident in my disease identification skills	47	2.1
C. I have adequate time to scout for diseases	50	2.6
D. Scouting diseases requires too much walking	45	1.9
E. I scout for diseases in my corn	49	2.4
F. An Extension Agent scouts my corn for diseases	47	1.4
G. An independent crop consultant scouts my corn for diseases	44	1.2
H. An agricultural supplier or agricultural chemical dealer scouts my corn for diseases	50	2.2
I. I select corn seed treated with fungicides	49	3.2
J. I select disease-resistant corn varieties	48	3.2
K. Scouting for diseases helps me decide if I need to rotate future crops to avoid diseases	49	3.0

SCOUTING FOR INSECTS

A. I personally scout my corn for insects	49	3.0
B. An Extension Agent scouts my corn for insects	45	1.6
C. An independent crop consultant scouts my corn for insects	44	1.3
D. An agricultural supplier or agricultural chemical dealer scouts my corn for insects	50	2.3
E. Scouting for insects requires too much time	48	2.0
F. Scouting for insects requires too much walking	47	1.7
G. Scouting for insects costs too much	48	1.6

CUTWORMS

A. I can identify cutworms	51	3.2
B. I am aware that cutworm thresholds are available	50	3.0
C. I use thresholds for cutworms in corn	47	2.5
D. Cutworm thresholds are easy to use	42	2.5
E. I have confidence in the cutworm thresholds	41	2.5
F. I have time to scout for cutworms	48	2.8
G. I apply insecticides for cutworm control	48	2.9

EUROPEAN CORN BORER

A. I plant corn early to reduce risk from European corn borer	47	2.9
B. I plant Bt corn to reduce risk from European corn borer if I plant after May 15	38	2.3

Appendix—Part 3 (A): Corn survey responses

ARMYWORMS

A. I can identify armyworms	50	3.3
B. I am aware that armyworm thresholds are available	47	3.1
C. I use thresholds for armyworms in corn	46	2.5
D. Armyworm thresholds are easy to use	44	2.6
E. I have confidence in the armyworm thresholds	42	2.5
F. I have time to scout for armyworms	45	2.8
G. I apply insecticides for armyworm control	48	2.6

WIREWORMS

A. I can identify wireworms	46	2.8
B. I have heard of monitoring wireworms using bait stations	44	2.4
C. I use bait stations to monitor wireworms in corn	44	1.3
D. I have time to monitor wireworms	45	2.2
E. Monitoring wireworms with bait stations is practical	38	2.0
F. I have confidence in the recommendations based on bait station wireworm captures	39	2.2
G. Wireworm thresholds are too complicated	37	2.1
H. I apply seed treatments or in-furrow insecticides for wireworms	44	2.6

WHITE GRUBS

A. I can identify white grubs	45	3.3
B. I have heard of monitoring white grubs using baited wire traps	41	2.3
C. I use baited wire traps to monitor white grubs in corn	42	1.4
D. I have time to monitor white grubs using baited wire traps	42	1.8
E. Monitoring white grubs with baited wire traps is practical	33	1.9
F. I have confidence in the white grub thresholds based on baited wire traps	33	1.9
G. White grub thresholds are too complicated	30	2.1
H. I apply seed treatments or in-furrow insecticides for white grubs and other corn seed pests	41	2.7
I. I have heard about thresholds based on using a shovel to dig and count white grubs prior to planting corn	41	2.3
J. I dig and count white grubs before planting corn	41	1.9
K. I have time to sample for white grubs using the digging technique	41	2.4
L. I have confidence in the thresholds based on digging and counting white grubs before planting corn	38	2.2
M. I check for corn seed pests when I check my planting depth	42	2.7

CORN IPM TOOLS

A. It is important to develop remote sensing tools, such as satellite photographs, to help scout weeds, diseases, and insects in corn	42	2.9
B. Integrated Pest Management (IPM) is important	45	3.5
C. I need more education on weed scouting	47	3.2
D. I need more education on disease scouting	47	3.2
E. I need more education on insect scouting	47	3.2

[1] Number of responses for each questionnaire item.

[2] Mean of all responses for each questionnaire item, using a 1-4 scale where 1 = very false and 4 = very true.

3-A (iii). Weed pests that are moderate or major pests in respondents' cornfields (n = 57).

Weed species	Number of respondents indicating weed is a pest in his/her cornfield	Percent of total
Annual (Italian) ryegrass	28	49.1
Hemp dogbane	10	17.5
Honeyvine milkweed	28	49.1
Horsenettle	10	17.5
Japanese bamboo	0	---
Johnsongrass	28	49.1
Lambsquarters	28	49.1
Morningglory	40	70.2
Mugwort/wild chrysanthemum	11	19.3
Pigweed	37	64.9
Shattercane	7	12.3
Trumpetcreeper	15	26.3
Write-ins		
Bermuda grass	1	1.8
Canadian thistle	2	3.5
Cocklebur	3	5.3
Jimsonweed	2	3.5
Nightshade	1	1.8
Nutgrass	1	1.8
Sicklepod	1	1.8
Wiregrass	2	3.5

3-A (iv). Diseases that are moderate or major pests in respondents' cornfields (n = 57).

Disease species	Number of respondents indicating disease is a pest in his/her cornfield	Percent of total
Fusarium	4	7.0
Gray leaf spot	16	28.1
Mosaic dwarf	2	3.5
Smut	18	31.6

3-A (v). Insects and other invertebrates that are moderate or major pests in respondents' cornfields (n = 57).

Insect species	Number of respondents indicating insect is a pest in his/her cornfield	Percent of total
Armyworm	17	29.8
Billbug	1	1.8
Corn root aphid	4	7.0
Corn rootworm	10	17.5
Cutworm	19	33.3
European corn borer	26	45.6
Grasshopper	4	7.0
Japanese beetle	6	10.5
Seedcorn maggot	19	33.3
Snail/slug	6	10.5
Stalk borer	15	26.3
White grub	21	36.8
Wireworm	18	31.6
Write-ins		
Corn earworm	2	3.5

3-A (vi). Crop damage caused by vertebrate animal pests of corn.

Animal pest	n[1]	Mean rating[2]
Deer	50	2.5
Crows	46	2.3
Geese	46	1.8
Write-ins		
Raccoon	1	4.0

[1] Number of responses for each questionnaire item.

[2] Mean of all responses for each questionnaire item, using a 1-4 scale where 1 = no economic damage and 4 = major damage.

3-A (vii). Use of IPM Internet resources by corn growers.

Corn survey participants were asked whether they use specific IPM resources available on Virginia Tech's website, and why they have or have not used it. They were instructed to mark all answers that applied. The number of responses is in parentheses.

1. Have you used the Virginia weed ID guide website? (www.ppws.vt.edu/weedindex.htm) (n = 53)

Yes (7) (13.2%)
No (46) (86.8%)

> **If you answered "No," why haven't you used it?**
> a. Never heard of it (20)
> b. No access to a computer (15)
> c. I feel uncomfortable using the computer (7)
> d. I went to the website, but the weed ID guide did not answer my questions (0)
> e. I already know my weed species (5)
> f. I use another weed identification source (16)
> g. Other reasons (write-ins): no Internet access (2); don't take the time (1)
>
> **If you answered "Yes," why have you used it?**
> a. Ease of use (4)
> b. Adequately covers the weeds that I encounter (5)
> c. I have confidence in the weed ID guide (2)
> d. Other reasons (write-ins): good source of information (1)

2. Have you used the Virginia Insect Control Expert for Corn (VICE Corn) website?
(www.isis.vt.edu/~pbhogar/vicecorn.html) (n = 53)

Yes (1) (1.9%)
No (52) (98.1%)

> **If you answered "No," why haven't you used it? Please circle all that apply.**
> a. Never heard of it (33)
> b. No access to a computer (15)
> c. I am uncomfortable using a computer (10)
> d. I went to the VICE Corn website, but it did not answer my questions (0)
> e. I went to the VICE Corn website, but did not have confidence in it (0)
> f. Other reasons (write-ins): no Internet access (2); have not needed it (2); knew the insects (1); time constraints (1)

If you answered "Yes," why have you used it? Please circle all that apply.
a. Ease of use (0)
b. Adequately covers the pests that I encounter (0)
c. I have confidence in the VICE Corn website (1)
d. Other reasons (0)

APPENDIX—Part 3-B: Soybean survey responses

Sixty-four of the 249 soybean surveys distributed were usable (25.7%). Survey responses, including write-in responses, are included in parts i-vii. Average soybean acreage grown in 2002 was 439.4 acres per respondent (median = 328.5 acres).

3-B (i). Virginia counties in which participants grew soybean in 2002 (n = 64).

County	Number of respondents growing soybean in this county	Percent of total
Caroline	11	17.2
Charles City	0	---
Essex	11	17.2
Gloucester	4	6.3
James City	0	---
King & Queen	8	12.5
King William	8	12.5
Lancaster	7	10.9
Mathews	2	3.1
Middlesex	1	1.6
New Kent	1	1.6
Northumberland	15	23.4
Richmond	14	21.9
Westmoreland	7	10.9
Write-ins		
Hanover	3	4.7
Henrico	1	1.6
King George	1	1.6
Spotsylvania	2	3.1

3-B (ii). Responses to questionnaire items by farmers about soybean IPM.

Questionnaire topic	n^1	Mean rating^2
SCOUTING FOR WEEDS		
A. I am concerned about weed problems in my soybean	62	3.5
B. I am confident in my weed identification skills	59	3.1
C. I have adequate time to scout for weeds	58	2.9
D. Scouting for weeds requires too much walking	58	2.2
E. I personally scout for weeds in my soybean	62	3.5
F. An Extension Agent scouts my soybean for weeds	48	1.6
G. An independent crop consultant scouts my soybean for weeds	48	1.5
H. An agricultural supplier or agricultural chemical dealer scouts my soybean for weeds	55	2.6
I. Scouting weeds helps me decide whether a herbicide application is needed in my soybean	62	3.6
J. Scouting weeds influences my choice of herbicide	59	3.5
K. Scouting helps me control/manage weeds in future crops	62	3.6
L. Scouting weeds helps me incorporate variable-rate or site-specific spray technologies on my farm	56	3.3

HERBICIDE APPLICATIONS

A.	I rotate herbicide modes of action between my crops to reduce the risk of herbicide-resistant weeds	55	3.2
B.	I make site-specific or variable-rate herbicide applications in soybean	50	2.9
C.	It is easier to treat the entire soybean field, rather than make site-specific applications	55	3.1
D.	Treating the entire soybean field gives better weed control than making site-specific herbicide applications	56	3.1
E.	Making site-specific herbicide applications saves money	53	3.4
F.	Making site-specific herbicide applications reduces wear and tear on equipment	54	3.1
G.	Making site-specific herbicide applications saves time	52	2.9

CULTIVATION

A.	I cultivate to control weeds in soybean (if you do <u>not</u> cultivate, please mark "very false," and skip to question "E")	55	1.1
B.	Cultivation is cost-effective	3	1.0
C.	I cultivate to reduce the number of chemical applications in my soybean	4	1.5
D.	Cultivation adequately controls weeds in my soybean	5	1.2
E.	I rely more on herbicides than cultivation to control weeds in soybean	49	3.9
F.	Soybean gets too tall for me to cultivate effectively	23	2.8
G.	I use reduced-till or no-till practices on my farm	51	3.9

MAPPING

A.	I make paper or computer maps of weed hotspots in my soybean fields	49	1.7
B.	Making paper or computer maps of weed hotspots is practical	47	2.3
C.	I make mental maps of weed hotspots in my soybean fields	53	3.2
D.	Mapping weed hotspots helps me manage weeds in future crops	46	3.0
E.	Mapping weeds hotspots helps me incorporate variable-rate or site-specific spray technology	41	2.8

CULTURAL WEED CONTROL

A.	I use rapid canopy closure (through narrow row spacing and/or early planting) to help shade out weeds in my soybean	57	3.6
B.	My equipment is capable of planting in narrow rows	56	3.8
C.	I have confidence in using rapid canopy closure to control weeds in soybean	57	3.5

DISEASE

A.	I am concerned about disease problems in my soybean	58	3.2
B.	I am confident in my disease identification skills	56	2.0
C.	I have adequate time to scout for diseases	56	2.6
D.	Scouting for diseases requires too much walking	53	2.1
E.	I scout for diseases in my soybean	52	2.6
F.	An Extension Agent scouts my soybean for diseases	47	1.7
G.	An independent crop consultant scouts my soybean for diseases	43	1.5
H.	An agricultural supplier or agricultural chemical dealer scouts my soybean for diseases	50	2.5
I.	I select soybean seed treated with fungicides	55	2.3
J.	I select disease-resistant soybean varieties	53	2.9
K.	Scouting helps me decide if I need to rotate future crops to avoid diseases	53	3.0

NEMATODES

A.	Nematodes are a problem in my soybean	45	2.2
B.	I can associate nematodes with the diseases that they cause	46	2.3
C.	I know how to take nematode samples	48	1.9
D.	Collecting nematode samples is practical	42	2.4
E.	I do not do predictive nematode assays because they are too expensive	38	2.2
F.	It takes too long to receive nematode test results from the lab	38	2.1
G.	I rotate crops to reduce risk from nematodes	51	3.4
H.	I use nematode-resistant soybean varieties	45	3.1
I.	In the long run, performing nematode assays saves me money	29	2.6

SCOUTING FOR INSECTS

A.	I personally scout my soybean for insects	54	3.4
B.	An Extension Agent scouts my soybean for insects	45	1.8
C.	An independent crop consultant scouts my soybean for insects	41	1.6
D.	An agricultural supplier or agricultural chemical dealer scouts my soybean for insects	50	2.8
E.	Scouting for insects requires too much time	54	2.1
F.	Scouting for insects requires too much walking	53	2.0
G.	Scouting for insects costs too much	54	1.6

CORN EARWORM

A.	I can identify corn earworms	57	3.7
B.	I am aware that corn earworm thresholds are available	55	3.6
C.	I use thresholds for corn earworm in soybean	52	3.4
D.	Corn earworm thresholds are easy to use	50	3.4
E.	I have confidence in the corn earworm thresholds	49	3.3
F.	I have time to scout for corn earworm	55	3.3
G.	I apply insecticides for corn earworm control	54	3.6

SOYBEAN IPM TOOLS

A.	It is important to develop remote sensing tools, such as satellite photographs, to help scout weeds, diseases, and insects in soybean	47	2.5
B.	Integrated Pest Management (IPM) is important	48	3.4
C.	I need more education on weed scouting	55	2.9
D.	I need more education on disease scouting	54	3.2
E.	I need more education on insect scouting	54	3.0
F.	Monitoring soybean fields for herbicide-resistant weeds is important	54	3.6
G.	Research should be done to determine thresholds for beneficial organisms in soybean	52	3.5

[1] Number of responses for each questionnaire item.
[2] Mean of all responses for each questionnaire item, using a 1-4 scale where 1 = very false and 4 = very true.

3-B (iii). Weed pests that are moderate or major pests in respondents' soybean fields (n = 64).

Weed species	Number of respondents indicating weed is a pest in his/her soybean field	Percent of total
Hemp dogbane	11	17.2
Lambsquarters	40	62.5
Marestail	11	17.2
Morningglory	54	84.4
Pigweed	35	54.7
Write-ins		
Binder	1	1.6
Broadleaf signalgrass	1	1.6
Cocklebur	5	7.8
Honeyvine milkweed	1	1.6
Horsenettle	1	1.6
Jimsonweed	4	6.3
Johnsongrass	3	4.7
Mugwort	1	1.6
Nightshade	1	1.6
Pokeberry	1	1.6
Pokeweed	1	1.6
Ragweed	3	4.7
Red root	2	3.1
Sheepbur	1	1.6
Sicklepod	1	1.6
Virginia creeper	1	1.6

3-B (iv-*a*). Diseases that are moderate or major pests in respondents' soybean fields (n = 64).

Disease species	Number of respondents indicating disease is a pest in his/her soybean field	Percent of total
Anthracnose	1	1.6
Bean pod mottle virus	1	1.6
Brown spot	3	4.7
Brown stem rot	3	4.7
Charcoal rot	1	1.6
Downey mildew	2	3.1
Frogeye	3	4.7
Fusarium	6	9.4
Peanut mottle virus	0	---
Phomopsis seed decay	1	1.6
Phytophthora root rot	8	12.5
Pod and stem blight	4	6.3
Purple seed stain	14	21.9
Red crown rot	1	1.6
Root knots	4	6.3
Soybean mosaic virus	1	1.6

3-B (iv-*b*). Frequency of nematode assays.

Farmers were asked the frequency of nematode assays for their soybean fields. They were asked to circle only one answer. The number of responses is in parentheses. (n = 57)

1. How often do you have nematode assays performed on your soybean fields?
       a. Every year (3)
       b. Every two or three years (5)
       c. Every four or more years (8)
       d. I've never had a nematode assay performed on my soybean fields (41)

3-B (v). Insects and other invertebrates that are moderate or major pests in respondents' soybean fields (n = 64).

Insect species	Number of respondents indicating insect is a pest in his/her soybean field	Percent of total
Armyworm	20	31.3
Corn earworm	51	79.7
Grasshopper	11	17.2
Green cloverworm	13	20.3
Mexican bean beetle	7	10.9
Potato leafhopper	0	---
Soybean looper	27	42.2
Spider mite	21	32.8
Stink bug	15	23.4
Thrips	17	26.6
Write-ins		
Bean leaf beetle	1	1.6

3-B (vi). Crop damage caused by vertebrate animal pests of soybean.

Animal pest	n[1]	Mean rating[2]
Deer	56	2.8
Groundhogs	57	3.1

[1] Number of responses for each questionnaire item.
[2] Mean of all responses for each questionnaire item, using a 1-4 scale where 1 = no economic damage and 4 = major damage.

3-B (vii). Use of IPM Internet resources by soybean growers.

Soybean survey participants were asked whether they use specific IPM resources available on Virginia Tech's website, and why they have or have not used it. They were instructed to mark all answers that applied. The number of responses is in parentheses.

1. Have you used the Virginia weed ID guide website? (www.ppws.vt.edu/weedindex.htm) (n = 59)

Yes (9) (15.3%)
No (50) (84.7%)

> **If you answered "No," why haven't you used it?**
> a. Never heard of it (25)
> b. No access to a computer (22)
> c. I feel uncomfortable using the computer (12)
> d. I went to the website, but the weed ID guide did not answer my questions (1)
> e. I already know my weed species (5)
> f. I use another weed identification source (12)
> g. Other reasons (write-ins): took weed course (1); guide not available (1); use effective herbicides (1); prefer hard-copy material (1); someone else checks (1)
>
> **If you answered "Yes," why have you used it?**
> a. Ease of use (4)
> b. Adequately covers the weeds that I encounter (8)
> c. I have confidence in the weed ID guide (6)
> d. Other reasons (write-ins): a picture is worth 1000 words (1); curious (1)

2. Have you used the corn earworm threshold calculator on the Internet? (www.ipm.vt.edu/cew/)
Yes (3) (4.7%)
No (61) (95.3%)

> **If you answered "No," why haven't you used it?**
> a. Never heard of it (31)
> b. No access to a computer (22)
> c. I am uncomfortable using a computer (12)
> d. I went to the website, but it did not answer my questions (1)
> e. The calculator did not represent my row spacing (0)
> f. The calculator did not represent my sampling technique (0)
> g. I use a hard-copy version of the corn earworm thresholds (11)
> h. Other reasons (write-ins): did not need it (1); communicate with Agent (1); base on own experience (1); takes too much time (1); no Internet access (1); do not spray low-value crops (1)
>
> **If you answered "Yes," why have you used it?**
> a. Ease of use (2)

Appendix—Part 3 (B): Soybean survey responses   79

b. Adequately represents my row spacing (1)
c. Adequately represents my sampling technique (1)
d. I have confidence in the thresholds (2)
e. Other reasons (write-ins): (0)

3. Do you use the corn earworm advisory?
Yes (32) (55.2%)
No (26) (44.8%)

If "No," why don't you use the corn earworm advisory?
a. Never heard of it (21)
b. It is not published in my local media (1)
c. I do not have confidence in the advisory (0)
d. I do not understand the advisory (0)
e. Other reasons (write-ins): no Internet access (1); do not spray low-value crops (1); get advice from others (1); do not need it (1)

If "Yes," why do you use the corn earworm advisory?
a. I use it to help make management decisions in my soybean (19)
b. It helps me decide when to begin scouting for corn earworm in my soybean (25)
c. I have confidence in the advisory (12)
d. It is easy to understand (10)
e. It is readily available (10)
f. Other reasons (write-ins): (0)

APPENDIX—Part 3-C: Small grains survey responses

Sixty-three of the 249 small grains surveys distributed were usable (25.3%). Survey responses, including write-in responses, are included in parts i-vii. Average small grains acreage grown in 2002 was 289.3 acres per respondent (median = 235.0 acres).

3-C (i). Virginia counties in which participants grew small grains in 2002 (n = 63).

County	Number of respondents growing small grains in this county	Percent of total
Caroline	5	7.9
Charles City	0	---
Essex	9	14.3
Gloucester	4	6.4
James City	0	---
King & Queen	9	14.3
King William	3	4.8
Lancaster	11	17.5
Mathews	1	1.6
Middlesex	5	7.9
New Kent	0	---
Northumberland	18	28.6
Richmond	13	20.6
Westmoreland	7	11.1

3-C (ii). Responses to questionnaire items by farmers about small grains IPM.

Questionnaire topic	n[1]	Mean rating[2]
SCOUTING FOR WEEDS		
A. I am concerned about weed problems in my small grains	58	3.7
B. I am confident in my weed identification skills	58	2.9
C. I have adequate time to scout for weeds	59	2.9
D. Scouting for weeds requires too much walking	54	2.1
E. I personally scout for weeds in my small grains	59	3.5
F. An Extension Agent scouts my small grains for weeds	47	2.0
G. An independent crop consultant scouts my small grains for weeds	44	1.8
H. An agricultural supplier or agricultural chemical dealer scouts my small grains for weeds	51	2.8
I. Scouting weeds helps me decide whether a herbicide application is needed in my small grains	58	3.8
J. Scouting weeds influences my choice of herbicide	57	3.7
K. Scouting helps me control/manage weeds in future crops	58	3.7
L. Scouting weeds helps me incorporate variable-rate/site-specific spray technologies on my farm	53	3.3
HERBICIDE APPLICATIONS		
A. I rotate herbicide modes of action between my crops to reduce the risk of herbicide-resistant weeds	54	3.2
B. I make site-specific or variable-rate herbicide applications in small grains	51	2.8
C. It is easier to treat the entire small grains field, rather than make site-specific applications	58	3.0

Appendix—Part 3 (C): Small grains survey responses   81

D. Treating the entire small grains field gives better weed control than making site-specific herbicide applications | 58 | 3.1
E. Making site-specific herbicide applications saves money | 52 | 3.3
F. Making site-specific herbicide applications reduces wear and tear on equipment | 51 | 3.0
G. Making site-specific herbicide applications saves time | 52 | 2.8

CULTIVATION
A. I cultivate to control weeds in small grains (if you do <u>not</u> cultivate, please mark "very false," and skip to question "E") | 55 | 1.5
B. Cultivation is cost-effective | 9 | 3.1
C. I cultivate to reduce the number of chemical applications in my small grains | 9 | 3.1
D. Cultivation adequately controls weeds in my small grains | 9 | 2.8
E. I rely more on herbicides than cultivation to control weeds in small grains | 53 | 3.5
F. Small grains get too tall for me to cultivate effectively | 27 | 3.3
G. I use reduced-till or no-till practices on my farm | 55 | 3.3

MAPPING
A. I make paper or computer maps of weed hotspots in my small grains fields | 50 | 1.8
B. Making paper or computer maps of weed hotspots is practical | 46 | 2.7
C. I make mental maps of weed hotspots in my small grains fields | 55 | 3.2
D. Mapping weed hotspots helps me manage weeds in future crops | 50 | 3.1
E. Mapping weed hotspots helps me incorporate variable-rate or site-specific spray technology | 46 | 2.7

DISEASE
A. I am concerned about disease problems in my small grains | 56 | 3.6
B. I am confident in my disease identification skills | 56 | 2.6
C. I have adequate time to scout for diseases | 57 | 2.9
D. Scouting for diseases requires too much walking | 55 | 2.0
E. I scout for diseases in my small grains | 54 | 3.3
F. An Extension Agent scouts my small grains for diseases | 49 | 2.1
G. An independent crop consultant scouts my small grains for diseases | 43 | 1.8
H. An agricultural supplier or agricultural chemical dealer scouts my small grains for diseases | 51 | 3.0
I. I select small grains seed treated with fungicides | 57 | 3.5
J. I select disease-resistant small grains varieties | 54 | 3.5
K. Scouting helps me decide if I need to rotate future crops to avoid diseases | 55 | 3.3

SCOUTING FOR INSECTS
A. I personally scout my small grains for insects | 52 | 3.6
B. An Extension Agent scouts my small grains for insects | 49 | 2.2
C. An independent crop consultant scouts my small grains for insects | 44 | 1.6
D. An agricultural supplier or agricultural chemical dealer scouts my small grains for insects | 52 | 3.0
E. Scouting for insects requires too much time | 51 | 1.8
F. Scouting for insects requires too much walking | 52 | 2.0
G. Scouting for insects costs too much | 50 | 1.6

CEREAL LEAF BEETLE
A. I can identify cereal leaf beetles | 53 | 3.8
B. I am aware that cereal leaf beetle thresholds are available | 52 | 3.8
C. I use thresholds for cereal leaf beetles in small grains | 50 | 3.5
D. Cereal leaf beetle thresholds are easy to use | 47 | 3.3
E. I have confidence in cereal leaf beetle thresholds | 48 | 3.3
F. I have time to scout for cereal leaf beetle | 53 | 3.2
G. I apply insecticides for cereal leaf beetle control | 53 | 3.8

APHIDS
A. I can identify aphids | 54 | 3.5

Appendix—Part 3 (C): Small grains survey responses

B.	I am aware that aphid thresholds are available	52	3.3
C.	I use thresholds for aphids in small grains	47	3.2
D.	Aphid thresholds are easy to use	47	3.0
E.	I have confidence in the aphid thresholds	48	3.0
F.	I have time to scout for aphids	50	3.1
G.	I apply insecticides for aphid control	51	3.4

SMALL GRAINS IPM TOOLS

A.	It is important to develop remote sensing tools, such as satellite photographs, to help scout weeds, diseases, and insects in small grains	44	2.9
B.	Integrated Pest Management (IPM) is important	47	3.6
C.	I need more education on weed scouting	49	3.2
D.	I need more education on disease scouting	50	3.3
E.	I need more education on insect scouting	47	3.0
F.	I need more education on differentiating between nutrient deficiencies and diseases in small grains	50	3.3
G.	More research should be done on developing genetically "tougher" and pest-resistant small grain varieties	51	3.7
H.	More research should be done on developing earlier-maturing small grains cultivars	48	3.4
I.	I need more educational programs on using a computer	48	3.1
J.	I need more educational programs about taking and electronically sending digital photographs	47	3.2

[1] Number of responses for each questionnaire item.
[2] Mean of all responses for each questionnaire item, using a 1-4 scale where 1 = very false and 4 = very true.

3-C (iii). Weed pests that are moderate or major pests in respondents' small grains fields (n = 63).

Weed species	Number of respondents indicating weed is a pest in his/her small grains field	Percent of total
Canadian thistle	8	12.7
Chickweed	34	54.0
Common milkweed	14	22.2
Cornflower	19	30.2
Henbit	28	44.4
Honeyvine milkweed	15	23.8
Italian ryegrass	47	74.6
Johnsongrass	19	30.2
Little barley	0	---
Marestail	10	15.9
Mugwort/wild chrysanthemum	11	17.5
Poanna	0	---
Speedwell	11	17.5
Tall meadow oat grass	1	1.6
Vetch	27	42.9
Virginia creeper	8	12.7
Wild garlic	42	66.7
Write-ins		
Bubbious oatgrass	1	1.6
Morningglory	1	1.6
Nightshade	1	1.6

3-C (iv). Diseases that are moderate or major pests in respondents' small grains fields (n = 63).

Disease species	Number of respondents indicating disease is a pest in his/her small grains field	Percent of total
Barley yellow dwarf virus	30	47.6
Head scab	23	36.5
Leaf rust	19	30.2
Powdery mildew	51	81.0
Septoria leaf and glume blotch	25	39.7
Spindle-streak mosaic virus	9	14.3
Take-all	8	12.7
Write-ins		
Tan spot	1	1.6

3-C (v). Insects and other invertebrates that are moderate or major pests in respondents' small grains fields (n = 63).

Insect species	Number of respondents indicating insect is a pest in his/her small grains field	Percent of total
Aphids	43	68.3
Armyworm	15	23.8
Cereal leaf beetle	50	79.4
Grasshopper	6	9.5
Hessian fly	4	6.4
Stink bug	5	7.9
Thrips	12	19.1
Write-ins		
Japanese beetle	1	1.6

3-C (vi). Crop damage caused by vertebrate animal pests of small grains.

Animal pest	n[1]	Mean rating[2]
Deer	52	2.5
Geese	49	2.2
Swans	41	1.5

[1] Number of responses for each questionnaire item.
[2] Mean of all responses for each questionnaire item, using a 1-4 scale where 1 = no economic damage and 4 = major damage.

3-C (vii). Use of IPM Internet resources by small grains growers.

Small grains survey participants were asked whether they use specific IPM resources available on Virginia Tech's website, and why they have or have not used it. They were instructed to mark all answers that applied. The number of responses is the first number in parentheses, followed by percent of total.

1. Have you used the Virginia weed ID guide website? (www.ppws.vt.edu/weedindex.htm) (n = 59)

Yes (5) (8.5 %)
No (54) (91.5%)

> **If you answered "No," why haven't you used it?**
> a. Never heard of it (21)
> b. No access to a computer (19)
> c. I feel uncomfortable using the computer (8)
> d. I went to the website, but the weed ID guide did not answer my questions (0)
> e. I already know my weed species (4)
> f. I use another weed identification source (15)
> g. Other reasons (write-ins): not effective enough (1); do not think about it (1)
>
> **If you answered "Yes," why have you used it?**
> a. Ease of use (2)
> b. Adequately covers the weeds that I encounter (2)
> c. I have confidence in the weed ID guide (3)
> d. Other reasons (write-ins): pictures are superior to text (1)